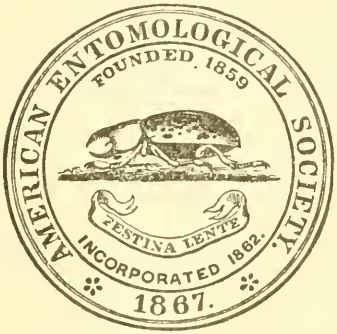
# TRANSACTIONS

OF THE

# AMERICAN

# ENTOMOLOGICAL SOCIETY




VOLUME XLIV

Smithsonian Institution
JAN 16 1919
247415
National Museum

HALL OF THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA

LOGAN SQUARE

1918

# LIST OF PAPERS


Cockerell (T. D. A.)
Neotropical Bees, principally collected by Professor Bruner in Argentina . . . . . 25
(Issued March 30, 1918.)

Cresson (E. T., Jr.)
Costa Rican Diptera, collected by Philip P. Calvert, Ph.D., 1909–1910. Paper 3.—A Report on the Ephydridae . . . . . 39
(Issued April 4, 1918.)

Dietz (William G.)
A Revision of the North American Species of the Tipulid Genus Pachyrhina Macquart, with Descriptions of New Species (Diptera) . . . . 105
(Issued June 10, 1918.)

Gibson (Edmund H.)
The Genus Corythucha Stål (Tingidae; Heteroptera) 69
(Issued April 4, 1918.)

Greene (George M.)
A Rare Coleoptera Paper of T. W. Harris . . 251
(Issued September 30, 1918.)

Hebard (Morgan)
New Genera and Species of Melanopli found within the United States (Orthoptera; Acrididae) . . 141
(Issued June 17, 1918.)

See Rehn and Hebard.

Malloch (J. R.)
Diptera from the Southwestern United States. Paper IV. Anthomyiidae . . . . . 263
(Issued October 28, 1918.)

Marchand (Werner)
The Evolution of the Abdominal Pattern in Tabanidae (Diptera) . . . . . 171
(Issued June 17, 1918.)

Rehn (James A. G.)
On Dermaptera and Orthoptera from Southeastern Brazil . . . . . 181
(Issued June 17, 1918.)

Descriptions of One New Genus and Fifteen New Species of Tropical American Orthoptera . . 321
(Issued November 20, 1918.)

Rehn (James A. G.) and Hebard (Morgan)
A Study of the North American Eumastacinae (Orthoptera; Acrididae) . . . . . 223
(Issued September 30, 1918.)

Swain (Albert F.)
New Aphididae from California . . . . . 1
(Issued March 28, 1918.)

Whedon (Arthur DeWitt)
The Comparative Morphology and Possible Adaptations of the Abdomen in the Odonata . . . 373
(Issued January 6, 1918.)

# INDEX

The names of new genera and of new species are followed by the name of the author.


PAGE

**Abbreviata** (Pachyrhina) . . . . . 111
abdominalis (Allotrichoma) . . . 54
Abraeris (see chapadensis)
Acanthocinus (see obsoleta)
Acontiothespis (see concinna)
Acrididae . . . . . 192, 329
acutipennis (Pegomyia) *Malloch* . . . . . **301**
Adimantus (see vitticeps)
Adimonia (see cristata)
aenea (Discocerina) *Cresson* . . 56, **59**
aequifrons (Limnophora) . . . . . 275
aesculi (Corythucha) . . . . . 76, 78
aestivus (Chlaenius) . . . . . 252
affinis (Pegomyia) . . . . . 302
agroecioides (Bertoniella) . . . . . 215
albicincta (Calythea) . . . . . 299
albocollaris (Melissodes) *Cockerell* . . . . . **30**, 36
alcathoë (Hylemyia) . . . . . 307
aldrichi (Pogonomyia) *Malloch* . . . . . 278, 279, **281**
alfaroi (Anaulacomera) *Rehn* . . **351**
Allognotha . . . . . 281
Allognotha (see semivitta)
Allotrichoma . . . . . 42, 54
Allotrichoma (see abdominalis)
alpicola (Pogonomyia) 277, 278, 279
alternata (Pachyrhina) *Dietz* 109, **117**
altissima (Pachyrhina) . . . . . 109
ambiguus (Planinasus) . . . . . 65
Amblytropidia (see ferruginosa)
ampla (Parossa) *Rehn* . . . . . **198**
Anaulacomera (see alfaroi, intermedia and sulcata)
angustiventris (Hylemyia) *Malloch* . . . . . **315**
Anobium (see peltatum)

PAGE

Anthomyia . . . . . 295, 298
Anthomyia (see pluvialis)
Anthomyiidae . . . . . 263
Anthomyiinae . . . . . 294
Anthophora (see paranensis)
anthracina (Hylemyia) *Malloch* . . . . . **314**
antiqua (Hylemyia) . . . . . 305
Anurogryllus (see muticus)
Aphis (see ramona and senecio)
apicalis (Eremomyia) . . . . . 303
approximata (Pachyrhina) *Dietz* . . . . . 112, **136**
arcuata (Corythucha) . . . . . 75, 101
arcuata (Elaeochlora) . . . . . 201
argentata (Brachydeutera) . . . . 67
argentata (Coenosia) . . . . . 285
argentina (Coptopteryx) . . . . . 188
Argiaeris *Hebard* . . . . . **166**
Argiaeris (see rehni)
argyrostoma (Paralimna) . . . . 45, 47
Aricia . . . . . 265, 270
Aricia (see brevis, latifrontata, lucorum, lysinoë, poecilopotera and punctata)
armipes (Hydrotaea) . . . . . 290
asinus (Hyalopteryx) . . . . . 193
assimilis (Fucellia) *Malloch* . . . **317**
assimilis (Gryllus) . . . . . 216
associata (Corythucha) . . . 74, 79
Atissiella *Cresson* . . . . . 42, **55**
Atissiella (see setulosa)
atra (Ochtheroidea) . . . . . 60
atramentata (Melissodes) *Cockerell* . . . . . **30**, 37
atrocera (Pachyrhina) *Dietz* 110, **118**
aurifrons (Schoenomyza) *Malloch* . . . . . 286, **288**
aurigera (Pycnopalpa) *Rehn* . . **353**

Basalis (Coenosia) ..... 284
bellula (Corythucha) *Gibson* ..75, **93**
benjamini (Fannia) ..... 292
bergii (Dichroplus) ..... 209
Bertoniella (see agroecioides)
betulae (Corythucha) *Drake* ..75, **86**
beutenmuelleri (Pachyrhina) *Dietz* .....111, **130**
bicolor (Pegomyia) ..... 303
bifasciata buccosa (Thygater) .28, 37
bimaculata morrilli (Melissodes) *Cockerell* .....**29**, 37
biolleyi (Eurycotis) *Rehn* ..... **321**
Blattidae .....186, 321
bohlsii (Fenestra) ..... 195
borealis (Corythucha) *Parshley* .....75, **92**
Brachydeutera .....42, 67
Brachydeutera (see argentata)
brasiliensis (Ischnoptera) ..... 186
brasiliensis (Pyragra) ..... 182
brasiliensis (Scyllina) ..... 196
brethesi (Tetralonia) .....35, 37
brevicornis (Pachyrhina) ..... 112
brevicornis (Truxalis) ..... 194
brevis (Aricia) ..... 271
brevitarsis (Hylemyia) *Malloch* ..... **309**
bruneri (Thygater) *Cockerell* ..**28**, 37
brunnea (Corythucha) *Gibson* .75, **93**
brunneiceps (Paralimna) .....45, 47
buccosa (Thygater) ..... 28
Bucephalomyia *Malloch* ...264, **273**
Bucephalomyia (see femorata)
Bucrates (see lanista)
bulbosa (Corythucha) .....74, 77

Cactocaetes (Chloroplus) *Hebard* ..... **146**
caelata (Corythucha) .....77, 101
californica (Morsea) .....229, 235
californiensis (Tetrameriux) *Malloch* ..... **274**
calinota (Pachyrhina) *Dietz* 110, **121**
calliginosa (Epilampra) ..... 187
callura (Diadasia) *Cockerell* ...**36**, 37
calverti (Ilythea) *Cresson* ....50, **51**
calverti (Hydrella) *Cresson* ...47, **48**
Calythea .....295, 299
Calythea (see albicincta)
Canace ..... 41
canellus (Cryptocephalus) ..... 260
caniceps (Ilythea) *Cresson* .... **50**
canonicus (Homalosaparus) ... 208
capillaris (Trox) ..... 255
carcaranensis (Svastra) *Cockerell* .....**35**, 37
celtidis (Corythucha) .....77, 84
centralis (Diedronotus) *Rehn*. **329**
centralis (Ochtheroidea) *Cresson* ..... 60
Centrinus (see dilectus and sutor)
Centris (see nigriventris)
Cephalocoema (see costulata)
Cerometopon ..... 42
Ceropsilopa ..... 42
Cerosipha (see cupressi)
chapadensis (Abracris) ..... 206
Chlaenius (see aestivus)
Chlorophylla (see inca)
Chloroplus *Hebard* ..... **146**
Chloroplus (see cactocaetes)
Chloroscirtus (see discocercus)
Chorisoneura (see personata)
Chromacris (see miles)
chrysolepis (Symydobius) *Swain* ..... **6**
chrysostoma (Schoenomyza) 286, 288
ciliata (Corythucha) .....75, 102
ciliata (Paralimna) .....45, 46
cilifera (Hylemyia) *Malloch* ... **311**
cinerella (Egle) ..... 299
cingulata (Pachyrhina) *Dietz* 111, **131**
clarkii (Sparatta) ..... 185
Clasiopella ..... 42
Clivina (see quadrimaculata and sphaericollis)
Clytus (see nobilis)
Coenosia (see argentata, basalis, fraterna, lata, ovata and setigera)
Coenosiinae ..... 281
collaris (Pachyrhina) ..... 108

coloradensis (Corythucha) *Gibson* . . . . . 76, **89**
concinna (Acontiothespis) . . . . . 188
confraterna (Corythucha) *Gibson* . . . . . 75, **102**
contaminata (Corythucha) *Gibson* . . . . . 76, **82**
contracta (Corythucha) . . . . . 104
convexifrons (Schoenomyza) *Malloch* . . . . . 286, **287**
Coptopteryx (see argentina)
cornifera (Pachyrhina) *Dietz* . . . . . 110, **120**
Cornops (see dorsatum, ignotum and politum)
coryli (Corythucha) . . . . . 74, 92
Corymbetes (see glyphicus and stagninus)
Corythucha (see aesculi, arcuata, associata, bellula, betulae, borealis, brunnea, bulbosa, caelata, celtidis, ciliata, coloradensis, confraterna, contaminata, contracta, coryli, cydoniae, cyrta, decens, distincta, drakei, elegans, eriodictyonae, exigua, floridana, fuscigera, fuscomaculata, gossypii, heidemanni, hispida, hoodiana, immaculata, incurvata, juglandis, lactea, mali, marmorata, mexicana, molliculata, morrilli, obliqua, occidentalis, padi, pallida, pallipes, parshleyi, pergandei, piercei, pruni, pura, salicata, salicis, setosa, spinosa, spinulosa, ulmi and unifasciata)
Coscineuta (see matensis)
costomaginata (Pachyrhina) *Dietz* . . . . . 111, **129**
costulata (Cephalococma) . . . . . 193
crassus (Diponthus) . . . . . 203
cristata (Adimonia) . . . . . 260
cristata (Galeruca) . . . . . 260
cruentata (Zoniopoda) . . . . . 202
Cryptocephalus (see canellus)
cupressi (Cerosipha) *Swain* . . . **19**
curvipes (Hylemyia) *Malloch* . . **316**
cydoniae (Corythucha) . . . . 75, 87
cylindrodes (Stenacris) . . . . . 203
cyrta (Corythucha) *Parshley* 75, **86**

Dasiapis (see tropicalis)
davidsoni (Myzocallis) *Swain* . . **1**
davisi (Eotettix) *Hebard* . . . . . **153**
decens (Corythucha) . . . . . 74, 96
decipiens (Lampyris) . . . . . 254
decipiens (Paralimna-Phaiosterna . . . . . 45
dentipes (Hydrotaea) . . . . . 290
depressa (Eremomyia) *Malloch* . . . . . **304**
Diadasia (see callura)
Dichroplus (see bergii, exilis, forcipatus and punctulatus)
Diedronotus (see centralis, discoideus and regularis)
dilectus (Centrinus) . . . . . 255
Diponthus (see crassus)
discocercus (Chloroscirtus) *Rehn* . . . . . **348**
Discocerina . . . . . 42, 55
Discocerina (see aenea, incisa, leucoprocta, nana, nepos, nitida, obscurella, parva, pulchra, setulosa and trilineata)
discoideus (Diedronotus) . . . . . 200
discreta (Limnophora) . . . . . 275
distincta (Corythucha) . . . . . 75, 81
divisa (Hydrophoria) . . . . . 297
dorsalis (Schoenomyza) 286, 287, 288, 289
dorsatum (Cornops) . . . . . 206
Doru (see lineare and luteipenne)
drakei (Corythucha) *Gibson* . . 77, **98**
Drymeia . . . . . 265
dumicola (Morsea) *Rehn and Hebard* . . . . . 229, **235**
duplicata (Hylemyia) *Malloch* . **308**

**E**ctecous (see hedyphonus)
Egle . . . . . 295, 299
Egle (see cinerella and hirta)
Elaeochlora (see arcuata and viridicata)
Elater (see militaris and rubricollis)
elegans (Corythucha) *Drake* . . 75, **89**
emarginata (Procolpia) . . . . . 199
Endecous (see itatibensis and lizeri)
cophila (Tetralonia) *Cockerell* . . **35**
Eotettix (see davisi and quercicola)
Ephydra . . . . . 41, 66
Ephydra (see rostrata)
Ephydrinae . . . . . 66
Epilampra (see caliginosa)
Eremomyia . . . . . 295, 303
Eremomyia (see apicalis and depressa)
eriodictyonae (Corythucha) . . 77, 99
erosa (Prionacris) . . . . . 203
Eurotettix (see schrottkyi)
erythrocera (Notiphila) . . . . . 43
erythrophrys (Pachyrhina) . . . . 109
Eucnemis (see triangularis)
eurycercus (Phaulotettix) *Hebard* . . . . . **143**
Eurycotis (see biolleyi)
evasa (Pachyrhina) *Dietz* . . 110, **124**
excelsior (Pachyrhina) . . . . . 109
exigua (Corythucha) *Drake* . . . 76, **83**
exilis (Dichroplus) . . . . . 209

**F**acialis (Hylemyia) *Malloch* . . **306**
facialis (Notiphila) . . . . . 43
Fannia (see benjamini, femoralis, fuscula, laevis, minutipalpis, plebeia, spathiophora, splendida and triangulifera)
Fanniinae . . . . . 291
fasciata (Neoblattella) . . . . . 187
fascicularis (Lamia) . . . . . 259
fascicularis (Mesosa) . . . . . 259
fascipennis (Ochtheroidea) *Cresson* . . . . . **60**
femoralis (Fannia) . . . . . 292
femorata (Bucephalomyia) . . . . 273
Fenestra (see bohlsii)
fenestralis (Ilythea) *Cresson* . . 50, **51**
ferrisi (Lachnus) *Swain* . . . . . **9**
ferruginea (Pachyrhina) . . . . . 111
ferruginosa (Amblytropidia) . . . 195
festina (Pachyrhina) *Dietz* . 110, **126**
filiformis (Leptysma) . . . . . 203
flavipes (Ilythea) . . . . . 50, 51
flavitarsis (Typopsilopa) . . . . . 53
floridana (Corythucha) . . . . . 76, 101
forcipatus (Dichroplus) *Rehn* . . **337**
fracta (Hylemyia) *Malloch* . . . . **305**
fratercula (Paraidemona) *Hebard* . . . . . **151**
fraterna (Coenosia) *Malloch* . . . **282**
frontalis (Notiphila) . . . . . 43, 44
Fucellia (see assimilis and maritima)
fulva (Xenaricia) . . . . . 273
fulvimana (Notiphila) . . . . . 43
fuscicauda (Phaonia) *Malloch* . . **269**
fusciceps (Hylemyia) . . . . . 317
fuscigera (Corythucha) . . . . . 76, 78
fuscomaculata (Corythucha) . 76, 89
fuscula (Fannia) . . . . . 294

**G**aleruca (see cristata)
Gastrops . . . . . 42, 63
Gastrops (see nigra)
gemmicula (Hesperotettix) *Hebard* . . . . . **158**
germari (Ommexecha) . . . . . 196
gilva (Tetralonia) . . . . . 35, 37
glaphyropus (Ochtheroidea) . . 60, 61
glyphicus (Corymbetes) . . . . . 252
gnata (Pachyrhina) *Dietz* . . 109, **118**
gorgon (Paralobaspis) *Rehn* . . . . **362**
gossypii (Corythucha) . . . . . 77, 96
gracilicornis (Pachyrhina) . . . . . 111
Grammadera (see janeirensis)
granulosus (Lytogaster) . . . . . 62
Gryllidae . . . . . 365
Gryllus (see assimilus)
Gymnocera (see lefebvrei)
Gymnoscirtetes (see morsei)

**H**amata (Pachyrhina) *Dietz* 110, **121**
Hammomyia.....296, 303
Hammomyia (see maculata)
hebardi (Nemobius)..... 215
hedyphonus (Ectecous)..... 216
heidemanni (Corythucha) *Drake*.....75, **87**
helios (Spathalium) *Rehn*..... **196**
hempeli (Zoniopoda)..... 202
Hesperotettix..... 158
Hesperotettix (see gemmicula, nevadensis termius and osceola)
hirsutula (Pachyrhina) *Dietz*... **118**
hirta (Egle) *Malloch*..... **299**
hispida (Corythucha)..... 77, 104
Hister (see obtusatus)
Holmbergiapis *Cockerell*..... **36**
Homalosaparus (see canonicus)
Homorocoryphus (see kraussi)
hoodiana (Corythucha)..... 76, 82
humilis (Napaea)..... 64
humilis (Oechthera)..... 65
Hyalopteryx (see asinus and rufipennis)
hybrida (Pachyrhina) *Dietz* 108, **113**
Hydrella.....41, 47
Hydrella (see calverti, hypoleuca, spinicornis and tibialis)
Hydrophoria.....295, 296
Hydrophoria (see divisa, subpellucida and uniformis)
Hydrotaea..... 289
Hydrotaea (see armipes, dentipes, metatarsata, occulta and unispinosa)
Hylemyia.....296, 305
Hylemyia (see alcathoë, angustiventris, anthracina, antiqua, brevitarsis, cilifera, curvipes, duplicata, facialis, fracta, fusciceps, marginella, mimetica, neomexicana, piloseta, spinilamellata, spiniventris, substriata, substriatella and variata)
hyoscyami (Pegomyia)..... 300
hypoleuca (Hydrella)..... 48, 49

**I**gnotum (Cornops) *Rehn*..... **204**
iheringi (Strongylopsalis) *Rehn* **183**
Ilythea.....42, 50
Ilythea (see calverti, caniceps, fenestralis, flavipes and obscura)
immaculata (Corythucha)...76, 103
immaculata (Nostima) *Cresson* **49**
inca (Chlorophylla) *Rehn*..... **360**
incisa (Discocerina)..... 58
incurva (Pachyrhina)..... 109
incurvata (Corythucha).....74, 92
infumata (Schistocerca)..... 208
inornatus (Meroncidius)..... 211
instabilis (Scyllina)..... 195
intermedia (Anaulacomera).... 210
ipiranga (Musoniella) *Rehn*.... **188**
irroratus (Neoconocephalus)... 212
Ischnoptera (see brasiliensis and mexicana)
itatibensis (Endecous) *Rehn*... **217**

**J**aneirensis (Grammadera).... 211
juglandis (Corythucha).....75, 80

**K**raussi (Homorocoryphus) ... 212

**L**abidura (see xanthopus)
lacaena (Tanymecus)..... 255
Lachnus (see ferrisi and taxifolia)
lactea (Corythucha) *Drake*...74, **94**
laevigatus (Prionus)..... 257
laevis (Fannia)..... 294
laevis (Ochtheroidea) *Cresson* .60, **61**
Lamia (see fascicularis and obsoleta)
Lampyris (see decipiens and nigricans)
lanceolatum (Microcentrum)... 211
lanista (Bucrates) *Rehn*..... **212**
lankesteri (Paraphidnia) *Rehn*. **344**
lata (Coenosia)..... 285
latifrons (Pogonomyia) *Malloch* 278, **281**

latifrontata (Aricia) *Malloch*... **270**
latifurcula (Paraidemona) *Hebard*..... **149**
lativittata (Pachyrhina) *Dietz* 111, **135**
lefebvrei (Gymnocera)..... 210
Leiotettix (see mendosensis)
Leptysma (see filiformis)
leucoprocta (Discocerina)....56, 58
leucostoma (Ophyra)..... 291
leucostoma (Svastra) *Cockerell* **34**, 38
Limnophora.....264, 265, 274
Limnophora (see acquifrons, discerta, narona and surda)
lineare (Doru)..... 186
linearis (Stenocorus)..... 259
lineata (Pachyrhina)..... 109
Lispa (see tentaculata)
Lispiinae..... 291
lizeri (Endecous) *Rehn*..... **365**
lucorum (Aricia)..... 271
lugens (Pachyrhina)..... 109
lusor (Xenoglossodes) *Cockerell* **32**, 37
luteipenne (Doru)..... 186
lysinoë (Aricia)..... 272
Lytogaster.....42, 61
Lytogaster (see granulosus, pallipes and willistoni)

Macrocera (Pachyrhina) 109, 110, 118
macrocera atrocera (Pachyrhina) *Dietz*.....110, **118**
macrocera gnata (Pachyrhina) *Dietz*.....109, **118**
macrocera virgata (Pachyrhina) *Dietz*..... **109**
macrophallus (Pachyrhina) *Dietz*.....108, **114**
Macrorchis (see majuscula)
maculata (Hammomyia)..... 303
maculiventris (Trichopticus) *Malloch*..... **276**
majuscula (Macrorchis)..... 286
mali (Corythucha) *Gibson*....77, **98**
manca (Xenoglossodes) *Cockerell*.....**33**, 37
Mantidae.....188, 326
marginella (Hylemyia) *Malloch* **311**
maritima (Fucellia)..... 318
marmorata (Corythucha)....76, 94
matensis (Coscineuta) *Rehn*... **331**
maureri (Myzocallis) *Swain*... **4**
meditabunda (Myiospila)..... 265
melanura (Xylocopa) *Cockerell* **29**
Melissodes (see albocollaris, atramentata, bimaculata morrilli, nigroaenea and svastrina)
Melissoptila (see pulchricornis)
mellitus (Molarchus)..... 260
mendosensis (Leiotettix) *Rehn*. **335**
meridionalis (Paralimna)....45, 46
meridionalis (Psilopa) *Cresson*. **52**
Meroncidius (see inornatus)
Mesosa (see fascicularis)
metatarsata (Hydrotaea)..... 291
mexicana (Corythucha) *Gibson* 76, **95**
mexicana (Ischnoptera)..... 187
Microcentrum (see lanceolatum, myrtifolium and philammon)
miles (Chromacris)..... 201
militaris (Elater)..... 252
mimetica (Hylemyia) *Malloch*.**313**
mimetica (Xenoglossodes)....33, 37
minor (Pogonomyia) *Malloch* 278, 279, **280**
minuta (Pegomyia) *Malloch*... **302**
minutipalpis (Fannia)..... 293
moestus (Tachyporus)..... 252
molliculata (Corythucha)....76, 90
Molorchus (see mellitus)
montana (Pachyrhina) *Dietz* 110, **123**
monticola (Phaonia) *Malloch*.. **266**
Morphology of Odonata..... 373
morrilli (Corythucha).....74, 95
morrisoni (Nectarosiphon) *Swain*..... **8**
Morsea.....225, 226

Morsea (see californica, cal. dumicola and cal. tamalpaisensis)
morsei (Gymnoscirtetes) *Hebard* **142**
Mosillus . . . . . 42
multicostata (Tettigidea) . . . . . 192
Muscina . . . . . 264
Musoniella (see ipiranga) . . . . .
muticus (Anurogryllus) . . . . . 216
Mydaea . . . . . 264
Myiospila . . . . . 264, 265
Myiospila (see meditabunda)
myrtifolium (Microcentrum) . . 211
Myzocallis (see davidsoni and maurei)

**N**ana (Discocerina) . . . . . 56
Napaea . . . . . 42, 64
Napaea (see humilis and nigripes)
narona (Limnophora) . . . . . 274
Nectarosphon (see morrisoni)
Nemobius (see hebardi)
nemorosa (Psilephydra) . . . . . 64
Neoblattella (see fasciata)
Neoconocephalus (see irroratus and vicinus)
neomexicana (Hylemyia) *Malloch* . . . . . **310**
Nephrotoma . . . . . 108
nepos (Discocerina) *Cresson* . . 56, **57**
nevadensis termius (Hesperotettis) *Hebard* . . . . . **163**
nexilis (Pachyrhina) *Dietz* . . 110, **125**
nictans (Pachyrhina) *Dietz* . 111, **129**
nigra (Gastrops) . . . . . 63
nigra (Scaphura) . . . . . 210
nigricans (Lampyris) . . . . . 253
nigricauda (Phaonia) *Malloch* . . **268**
nigrina (Parasparatta) . . . . . 185
nigripes (Napaea) *Cresson* . . . . . **64**
nigriventris (Centris) . . . . . 29
nigroaenea (Melissodes) . . 31, 37, 38
nitens (Pogonomyia) . . . . . 278, 279
nitida (Discocerina) *Cresson* . . 56, **57**
nitida (Scaphura) . . . . . 209
nitidifrons (Plagiops) *Cresson* . **54**
nitidifrons (Scatella) *Cresson* **67**
nobilis (Clytus) . . . . . 258
nobilis (Pachyrhina) . . . . . 108
Nostima . . . . . 41, 49
Nostima (see immaculata and slossonae)
Notiphila . . . . . 41, 43
Notiphila (see erythrocera, facialis, frontalis, fulvimana and virgata)

**O**bliqua (Corythucha) . . . . . 76, 84
obliterata (Pachyrhina) *Dietz* 111, **133**
obscura (Hythea) *Cresson* . . . 50, **52**
obscura (Paralimna-Phaisterna) 45
obscurella (Discocerina) . . . . . 56, 58
obsoleta (Acanthocinus) . . . . . 259
obsoleta (Lamia) . . . . . 259
obtusatus (Hister) . . . . . 255
occidentalis (Corythucha) *Drake* 74, **91**
occidentalis (Pachyrhina) . . . . . 111
occipitalis (Pachyrhina) . . . . . 111
occulta (Hydrotaea) . . . . . 289
Ochthera . . . . . 41, 65
Ochthera (see humilis)
Ochtheroidea . . . . . 42, 59
Ochtheroidea (see atra, centralis, fascipennis, glaphyropus, laevis and similis)
Odonata, Anatomy of Abdomen . . . . . 373
Odonata, Morphology . . . . . 373
okefenoke (Pachyrhina) . . . . . 110
Ommexecha (see germari and servillei)
opacivittata (Pachyrhina) *Dietz* 110, **123**
Ophyra . . . . . 291
Ophyra (see leucostoma)
Orphula (see pagana)
Orphulella (see punctata)
Orphulina (see veteratoria)
osceola (Hesperotettix) *Hebard* **161**
oslari (Pachyrhina) *Dietz* . . 108, **112**
Osmilia (see violacea)
ovata (Cornosia) . . . . . 283
Oxytelus (see rugulosus) . . . . . 252

**P**achyrhina..... 108
Pachyrhina (see abbreviata, alternata, altissima, approximata, atrocera, beutenmuelleri, brevicornis, calinota, cingulata, collaris, cornifera, costomarginata, erythrophrys, evasa, excelsior, ferruginea, festina, gnata, gracilicornis, hamata, hirsutula, hybrida, incurva, lativittata, lineata, lugens, macrocera, macrocera atrocera, macrocera gnata, macrocera virgata, macrophallus, montana, nexilis, nictans, nobilis, obliterata, occidentalis, occipitalis, okefenoke, opacivittata, oslari, pachyrhinoides, pedunculata, penumbra, perdita, pilosula, polymera, pruinosa, puncticollis, punctura, snowii, snowii alternata, sodalis, sodalis nictans, stigmatica, suturalis, temeraria, tenuis hamata, unifasciata, unimaculata, urocera, virescens, virgata, vittula, wulpiana, wyalusingensis and xanthostigma)
Pachyrhinae..... 108
Pachyrhinae tipuloides..... 108
pachyrhinoides (Pachyrhina).. 108
padi (Corythucha).....75, 88
pagana (Orphula)..... 194
pallida (Corythucha).....76, 100
pallipes (Corythucha) *Parshley* 77, **82**
pallipes (Lytogaster)..... 62
Paraidemona (see fratercula and latifurcula)
Para'imna.....41, 44
Paralimna (see argyrostoma, brunneiceps, ciliata, decipiens, meridionalis, obscura and puncticornis)
Paralobaspis (see gorgon)
paranensis (Anthophora)..... 29
Paraphasma (see paulense)
Paraphidnia (see lankesteri)
Parasparatta (see nigrina)
Parossa (see ampla)
parshleyi (Corythucha) *Gibson* 76, **83**
partita (Schoenomyza) *Malloch* 287, **289**
parva (Discocerina)..... 58
parviceps (Phaonia) *Malloch*.. **267**
paulense (Paraphasma) *Rehn*.. **191**
paulista (Tafalisca) *Rehn*..... **219**
pedunculata (Pachyrhina)..... 109
Pegomyia.....295, 300
Pegomyia (see acutipennis, affinis, bicolor, hyoscyami and minuta)
peltatum (Anobium)..... 254
penumbra (Pachyrhina)..... 109
perdita (Pachyrhina) *Dietz*. 109, **116**
pergondei (Corythucha).....75, 91
personata (Chorisoneura)..... 188
Phaiosterna (see decipiens and obscura)
Phaonia.....264, 266
Phaonia (see fuscicauda, monticola, nigricauda and parviceps)
Phaoniinae..... 264
Phaulotettix (see eurycercus)
philammon (Microcentrum) *Rehn*..... **357**
piercei (Corythucha) *Gibson*. .77, **85**
piloseta (Hylemyia) *Malloch*... **313**
pilosula (Pachyrhina) *Dietz*.... **110**
Plagiops, *Cresson*.....42, **53**
Plagiops (see nitidifrons)
Planinasus (see ambiguus)
plebeia (Fannia) *Malloch*..... **293**
pluvialis (Anthomyia)..... 298
poeciloptera (Aricia) *Malloch*.. **271**
Pogonogaster *Rehn*..... **326**
Pogonogaster (see tristani)
Pogonomyia.....265, 276
Pogonomyia (see aldrichi, alpicola, latifrons, minor, nitens, similis and spinitarsus)

politum (Cornops) ..... 204
polymera (Pachyrhina) ..... 112
precaria (Stagmatoptera) ..... 190
Prionacris (see erosa)
Prionus (see laevigatus)
Procolpia (see emarginata)
pruinosa (Pachyrhina) ..... 110
pruni (Corythucha) ..... 76, 80
Psilephydra ..... 41, 63
Psilephydra (see nemorosa)
Psilopa ..... 42, 52
Psilopa (see meridionalis and willistoni)
Psychomastax *Rehn* and *Hebard* ..... 225, **242**
Psychomastax (see psylla)
psylla (Psychomastax) *Rehn* and *Hebard* ..... **243**
pulchra (Discocerina) *Cresson* .. **56**
pulchricornis (Melissoptila) *Cockerell* ..... **32**, 37
punctata (Aricia) ..... 271
punctata (Orphulella) ..... 195
puncticollis (Pachyrhina) *Dietz* 108, **115**
puncticornis (Paralimna) ..... 45, 47
punctulatus (Dichroplus) ..... 209
punctum (Pachyrhina) ..... 110
pura (Corythucha) ..... 77
pusillus (Tomicus) ..... 257
Pycnopalpa (see aurigera)
pygialis (Thygater) ..... 29
Pyragra (see brasiliensis)

**Q**uadrimaculata (Clivina) ..... 252
quercicola (Eotettix) *Hebard* .. **156**

**R**unona (Aphis) *Swain* ..... **14**
reductior (Svastra) *Cockerell* . . **35**, 37
regularis (Diedronotus) ..... 200
rehni (Argiacris) *Hebard* ..... **167**
rhodophila (Xenoglossa) *Cockerell* ..... **27**, 37
rostrata (Ephydra) *Cresson* .... **66**
rubricollis (Elater) ..... 253
rufipennis (Hyalopteryx) ..... 194
rugulosus (Oxytelus) ..... 252

**S**alicata (Corythucha) *Gibson* . 77, **90**
salicis (Corythucha) ..... 76, 85
sapucacensis (Svastra) *Cockerell* **34**, 37
Scaphura (see nigra and nitida)
Scatella ..... 41, 66
Scatella (see nitidifrons and stagnalis)
Scatophila ..... 41, 67
Scatophila (see variabilis)
Schistocerca (see infumata)
Schoenomyza ..... 286
Schoenomyza (see aurifrons, convexifrons, chyrsostoma, dorsalis, partita and sulfuriceps)
schrottkyi (Eurotettix) *Rehn* . . . **341**
Scyllina (see brasiliensis and instabilis)
semivitta (Allognotha) *Malloch* **282**
senecio (Aphis) *Swain* ..... **16**
servillei (Ommexecha) ..... 196
setigera (Coenosia) *Malloch* .... **284**
setosa (Corythucha) ..... 77, 100
setulosa (Atissiella) *Cresson* .... **55**
setulosa (Discocerina) *Cresson* 56, **58**
similis (Ochtheroidea) *Cresson* 60, **61**
similis (Pogonomyia) *Malloch* 278, **279**
similis (Zoniopoda) ..... 203
slossonae (Nostima) ..... 49
smaragdinum (Temnosoma) ... 29
snowii (Pachyrhina) ..... 109
snowii alternata (Pachyrhina) *Dietz* ..... 109, **117**
sodalis (Pachyrhina) ..... 111, 129
sodalis nictans (Pachyrhina) *Dietz* ..... 111, **129**
Sparatta (see clarkii)
Spathalium (see helios)
spathiophora (Fannia) *Malloch* **294**
spectrum (Tribonium) ..... 188
sphaericollis (Clivina) ..... 252
spinicornis (Hydrella) *Cresson* **48**
spinilamellata (Hylemyia) *Malloch* ..... **312**
spinitarsus (Pogonomyia) . . 277, 279
spiniventris (Hylemyia) ..... 311

spinosa (Corythucha) . . . . . 77, 99
spinulosa (Corythucha) *Gibson* 75, **79**
splendida (Fannia) . . . . . 292
Stagmatoptera (see precaria)
stagnalis (Scatella) . . . . . 66
stagninus (Corymbetes) . . . . . 252
Stenacris (see cylindrodes)
Stenocorus (see linearis)
stigmatica (Pachyrhina) *Dietz* 112, **137**
Strongylopsalis (see iheringi)
sublaevis (Tetanorhynchus) . . . 193
subpellucida (Hydrophoria) *Malloch* . . . . . **296**
substriata (Hylemyia) . . . . . 316
substriatella (Hylemyia) *Malloch* . . . . . **309**
sulcata (Anaulacomera) . . . . . 210
sulfuriceps (Schoenomyza) *Malloch* . . . . . 286, **288**
surda (Limnophora) . . . . . 275
sutor (Centrinus) . . . . . 256
suturalis (Pachyrhina) . . . . . 111
Svastra (see carcaranensis, leucostoma, reductior and sapucacensis)
svastrina (Melissodes) *Cockerell* **31**, 38
Symydobius (see chrysolepis)

**T**abanidae—abdominal pattern 171
Tachyporus (see moestus)
Tafalisca (see paulista)
tamalpaisensis (Morsea) . . . 229, 239
Tanymecus (see lacaena)
tarsata (Zoniopoda) . . . . . 202
taxifolia (Lachnus) *Swain* . . . . . **11**
Teleutemnesta . . . . . 36
temeraria (Pachyrhina) *Dietz* 110, **128**
Temnosoma (see smaragdinum)
tentaculata (Lispa) . . . . . 291
tenuis (Pachyrhina) . . . . . 110
tenuis hamata (Pachyrhina) *Dietz* . . . . . 110, **121**
termius (Hesperotettix) *Hebard* **163**
Tetanorhynchus (see sublaevis)
Tetralonia (see brethesi, eophila and gilva)
Tetramerinx . . . . . 264, 273
Tetramerinx (see californiensis)
Tettigidea (see multicostata)
Tettigoniidae . . . . . 209, 344
Thygater (see bifasciata buccosa, bruneri and pygialis)
tibialis (Hydrella) . . . . . 47, 48
Tomicus (see pusillus)
trachystictum (Zygoclistron) . . . 208
triangularis (Eucnemis) . . . . . 253
trianguligera (Fannia) *Malloch* **292**
Tribonium (see spectrum)
Trichopticus . . . . . 264, 265, 275
Trichopticus (see maculiventris)
trilineata (Discocerina) *Cresson* 56, **57**
tristani (Pogonogaster) *Rehn* . . **327**
tropicalis (Dasiapis) *Cockerell* **27**, 37
Trox (see capillaris)
Truxalis (see brevicornis)
Typopsilopa . . . . . 42, 53
Typopsilopa (see flavitarsis)

**U**lmi (Corythucha) . . . . . 77, 97
unifasciata (Corythucha) . . . . 76, 97
unifasciata (Pachyrhina) . . . . . 111
uniformis (Hydrophoria) *Malloch* . . . . . **297**
unimaculata (Pachyrhina) . . . . . 108
unispinosa (Hydrotaea) . . . . . 290
urocera (Pachyrhina) *Dietz* 110, **119**

**V**ariabilis (Scatophila) . . . . . 67
variata (Hylemyia) . . . . . 309
veteratoria (Orphulina) . . . . . 194
vicinus (Neoconocephalus) . . . . 212
violacea (Osmilia) . . . . . 207
virescens (Pachyrhina) . . . . . 109
virgata (Notiphila) . . . . . 43, 44
virgata (Pachyrhina) *Dietz* . . . . **109**
viridicata (Elaeochlora) . . . . . 200
vitticeps (Adimantus) . . . . . 208
vittula (Pachyrhina) . . . . . 109

**W**illistoni (Lytogaster)..... 62
willistoni (Psilopa) *Cresson*...52, **53**
wulpiana (Pachyrhina)..... 110
wyalusingensis (Pachyrhina)
*Dietz*.....111, **134**

**X**anthopus (Labidura)..... 183
xanthostigma (Pachyrhina)... 111
Xenaricia *Malloch*.....264, **272**
Xenaricia (see fulva)
Xenoglossa (see rhodiphila)
Xenoglossodes (see lusor, manca and mimetica)
Xylocopa (see melanura)

**Z**oniopoda (see cruentata, hempeli, similis and tarsata)
Zygoclistron (see trachystictum)

VOLUME XLIV NUMBER 1

MARCH 1918

# TRANSACTIONS

OF THE

# AMERICAN ENTOMOLOGICAL SOCIETY

PUBLISHED BY THE AMERICAN ENTOMOLOGICAL SOCIETY AT THE ACADEMY OF NATURAL SCIENCES

PHILADELPHIA

SUBSCRIPTION PRICE FOUR DOLLARS PER VOLUME

# THE AMERICAN ENTOMOLOGICAL SOCIETY

PHILADELPHIA

Founded 1859 Incorporated 1862

Organized as "The Entomological Society of Philadelphia," the present title was adopted February 11, 1867.


PRESIDENT
Henry Skinner

VICE-PRESIDENT
James A. G. Rehn

CORRESPONDING SECRETARY
Morgan Hebard

RECORDING SECRETARY
R. C. Williams, Jr.

TREASURER
Ezra T. Cresson

PUBLICATION COMMITTEE
James A. G. Rehn
*Editor*
Ezra T. Cresson
Philip P. Calvert

FINANCE COMMITTEE
James A. G. Rehn
*Chairman*
D. M. Castle
Morgan Hebard

PROPERTY COMMITTEE
Ezra T. Cresson, Jr.
*Librarian* and *Custodian*
Morgan Hebard
Philip Laurent


Meetings held (alternately with those of the Entomological Section of the Academy of Natural Sciences of Philadelphia) on the fourth Thursday of September, October, November, January, February, March, April and May, and on the second Monday of June and December (annual meeting). The offices, meeting room, library and collections of the Society are in the Entomological Department of the Academy of Natural Sciences of Philadelphia, Logan Square.

## SERIAL PUBLICATIONS OF THE SOCIETY

Proceedings of the Entomological Society of Philadelphia, volumes I–VI, 1861–1867. Out of print and cannot be supplied.

Transactions of the American Entomological Society, volumes I–VI, out of print and cannot be supplied; V–X, $5.00 per volume; XI–XLIII, $4.00 per volume. Published in annual volumes of quarterly parts.

The Practical Entomologist, volumes I–II, 1865–1867. Price, $1.00 for the two volumes.

Memoirs of the American Entomological Society, number 1, 1916, price $2.00; number 2, 1917, price $4.50. Published irregularly.

Entomological News, volumes I–XXVIII. Price $2.00 per volume. Published in conjunction with the Entomological Section of the Academy of Natural Sciences of Philadelphia.

Various irregular, non-serial publications have been issued, which may be found in our price lists under their respective authors.

To establish the date of issue, each paper, as soon as completed, is placed on sale and a copy of it is mailed to each of the following institutions, with a request that it be placed in their library for reference.

Boston Society of Natural History
American Museum of Natural History
Smithsonian Institution
Field Museum of Natural History
California Academy of Sciences
Entomological Society of Ontario

Separates of papers published in the Proceedings and Transactions, if not out of print, can be supplied at prices given in our price lists, which are sent upon application, stating order or orders desired. The Society has also inaugurated a system of subscription to papers published by it on individual orders, which arrangement is of material benefit to the student who desires promptly the literature on any special group, but who does not desire to subscribe to entire volumes of the Transactions. A method of notification of the appearance in its publications of papers relating to individual orders or subjects has been developed by the Society. Information concerning these arrangements supplied upon application.

In sending subscriptions or in making inquiries relative to publications, address:

THE AMERICAN ENTOMOLOGICAL SOCIETY,
PUBLICATION DEPARTMENT,
The Academy of Natural Sciences of Philadelphia,
Logan Square.

TRANSACTIONS
OF THE
AMERICAN ENTOMOLOGICAL SOCIETY

VOLUME XLIV

# NEW APHIDIDAE FROM CALIFORNIA[1]

BY ALBERT F. SWAIN

*University of California Citrus Experiment Station, Riverside, California*

It is the purpose of this paper to describe several new species of *Aphididae* taken during the past few years in California. Many of these species have been taken by the writer in his study of the plant lice during the past three years, while some others have been obtained from various people in different parts of the state. The species recorded here represent collections made in the vicinity of Sacramento; in the San Francisco Bay region, particularly in the vicinity of Stanford University and in Berkeley; and in Southern California, particularly in San Diego, Riverside, and Ventura Counties. Cotype specimens of all the species are in the writer's private collection in Riverside and in the collection of the University of California, Berkeley.

**Myzocallis davidsoni** new species (Figs. 1, 15, 34, 35, 36.)

In the fall of 1915 the writer found a large infestation of a species of *Myzocallis* on *Quercus pedunculata* in Berkeley. On examination this proved to be the same species which had been taken several times on various species of chestnuts (*Castanea* spp.) and considered as *Calaphis castaneae* (Fitch). It is a common species in the San Francisco Bay region, having been reported several times from Berkeley, Oakland, Stanford University

[1] Paper No. 41, University of California, Graduate School of Tropical Agriculture and Citrus Experiment Station, Riverside, California.

and San José, as *Callipterus (Calaphis) castaneae* Fitch (Buckton).[2] However, it proves to be distinct from this species as brought out by a study of specimens together with Baker's paper on the genus *Calaphis*.[3] The chief differences are the absence of antennal tubercles, thus placing the species in the genus *Myzocallis* rather than *Calaphis*, and the fact that the spur of the sixth antennal segment is scarcely twice as long as the base, while in *C. castaneae* (Fitch) the spur is practically four times as long as the base. There is little doubt but that the California species is distinct, so the author describes it herewith under the name of *Myzocallis davidsoni* new species, naming it after Mr. W. M. Davidson of the Bureau of Entomology. The alate stem mothers appear rather late in the spring, usually during the latter part of April or the first of May. These reproduce parthenogenetically throughout the summer, both alate and apterous viviparous females being produced. In the fall, usually during October and November, sexual forms appear, the males being alate and the oviparous females apterous. The sexupara are alate, at least in all collections seen by the writer in which there were sexual forms, only alate presexual forms were present. The writer has never observed the eggs, but they are laid during October and November on the bases of the buds, or on roughened parts of the bark of the branches, and even of the trunks of the trees. In September 1915, the writer found an infestation of this species on *Quercus pedunculata* in Berkeley, and in April 1916, Essig took it again from the same trees. Davidson[4] described the alate male and the apterous oviparous females under the name *Calaphis castaneae* (Buckton), from specimens taken in San José in November. Following is a description of the alate and apterous viviparous females, taken from specimens collected by the writer

[2] Clarke, W. T., List of California Aphididae, Can. Ent., *35*: 249, 1903, *Callipterus castaneae* Fitch, list; Davidson, W. M., Further Notes on the Aphididae Collected in the Vicinity of Stanford University, Jour. Econ. Ent., *3*: 376, 1910, *Callipterus castaneae* Buckton, list; Davidson, W. M., Aphid Notes from California, Jour. Econ. Ent., *5*: 405, 1912, *Calaphis castaneae* (Buckton), desc. sexes; Essig, E. O., Aphididae of Southern California, Pom. Jour. Ent., *4*: 760, 1912.

[3] Baker, A. C., A synopsis of the genus *Calaphis*, Proc. Ent. Soc. Washington, *18*: 184–189, 1916.

[4] Davidson, W. M., Aphid Notes from California, Jour. Econ. Ent., *5*: 405, 1912.

in Berkeley from *Castanea* on July 31, 1915 (collection number *AFS 61–15*), and from *Quercus pedunculata* on September 26, 1915 (collection number *AFS 74–15*), and by Essig from *Castanea* in Berkeley on October 10, 1914 (collection number *EOE 70*). Cotype specimens are in the private collection of E. O. Essig, the private collection of the writer, and the collection of the University of California under the numbers listed above.

*Alate viviparous female.*—Prevailing color is lemon yellow. The head and prothorax have a black median longitudinal stripe and a similar one on each margin. The thoracic lobes are light brown, with the median part of each lobe slightly darker. The abdomen is lemon yellow with four rows of black spots, one row on each margin and two dorsal rows. These dorsal spots vary considerably in size, those on the fourth, fifth, and sixth segments being the largest, oftentimes being confluent, thus forming black transverse bands across these segments. The cornicles are dusky, the cauda and anal plate pale with the posterior margins darker. The legs are pale with the apical half dusky, and the tarsi and tips of the tibiae black. The antennae are grayish with the spur and tips of III–VI dusky.

The head (fig. 1) is almost triangular, being over twice as wide as long and coming to a distinct point at the apex between the cornicles. The antennal tubercles are lacking, or very small and indistinct. The antennae are about as long as the body, III being the longest segment, followed by IV, V, VI spur, VI base, I and II. The spur of VI is slightly more than half as long again as the base, together being longer than V, but shorter than IV. The usual primary and accessory sensoria are present on VI and the primary sensorium on V. On III there are from five to eight circular secondary sensoria, located in the basal two-thirds of the segment (fig. 15). The body is without lateral tubercles and without dorsal tubercles on the abdomen. The cornicles are almost cylindrical, being slightly broader at the base than at the apex (fig. 34). The cauda is knobbed (fig. 35) and set on a broad base; the anal plate is bilobed (fig. 36). The wing venation is normal. The costal vein is brown, the subcostal and stigma gray. The discoidals are brown and quite distinct, the first being slightly heavier than the others. The tips of the veins and the apex of the stigma are shaded with grayish-brown.

Measurements: Body length, 1.09–1.46 mm. (ave. 1.28 mm.): width of thorax, .468–.620 mm. (ave. .59 mm.): antennae total, 1.0965–1.751 mm. (ave. 1.4404 mm.); III, .357–.646 mm. (ave. .04977 mm.); IV, .238–.408 mm. (ave. .3231 mm.); V, .17–.281 mm. (ave. .2321 mm.); VI base, .068–.119 mm. (ave. .1038 mm.); VI spur, .1275–.0204 mm. (ave. .1816 mm.): cornicles, .08–.11 mm. (ave. .0974 mm.): cauda, .08–.09 mm. (ave. .086 mm.): hind tarsus, .12 mm.: wing length, 2.65 mm.; wing width, 1.01 mm.: wing expansion, 5.9 mm.

A very few of the alate females are without dorsal markings on the abdomen, but probably they are newly emerged adults, in which the colors have not as yet set.

*Apterous viviparous female.*—There is a considerable variety in the coloring of the apterous females. Some are pale lemon-yellow with pale brown spots on the abdomen and thorax to correspond with those of the alates. Some are pale lemon-yellow without dorsal markings, and others with slightly dusky markings here and there at the bases of some of the abdominal hairs. Others are of a pinkish color with the head and thorax pinkish-orange and the abdomen pinkish, with three small luteous spots caudad to a large median dorsal luteous spot. These three spots are located almost in a transverse line between the cornicles. The cornicles and cauda are pale. The legs are pale with the joints sometimes dusky. The antennae are luteous with the spur and the apices of segments III–VI dusky. The whole body is covered with fairly long capitate hairs, each arising from a more or less distinct tubercle, as is common in this genus.

Measurements: Body length, 2.18 mm.; width, .90 mm.: antennae total, 1.41 mm.; III, .39 mm.; IV, .31 mm.; V, .24 mm.; VI, base .14 mm.; VI, spur, .16 mm.

**Myzocallis maureri** new species (Figs. 2, 17, 29, 33, 39.)

In the summer of 1915, the writer took a few specimens of a species of *Myzocallis* from the under side of the leaves of coast live oak (*Quercus agrifolia*), on the campus of the University of California in Berkeley. He first found it on June 9, 1915, and then several times later, throughout June and July. George Shinji, a graduate student in the University, had already collected the same species in March. In April 1916, Essig sent the author a few specimens taken at that time in Berkeley. Only the alate viviparous females and the nymphs have been taken. In June 1916, the writer found it fairly abundant on the under side of the leaves of the California black oak (*Quercus kelloggii*), in the Cuyamaca Mountains of San Diego County, at an altitude of 3500 to 5000 feet. Here it was found only on the black oak, although in several cases a live oak (*Quercus agrifolia*) and a black oak were growing side by side, the former free from infestation, the latter more or less heavily infested. This latter observation is interesting, for in Berkeley the live oak was the only observed host plant. Specimens taken in Berkeley were examined by W. M. Davidson, J. J. Davis and E. O. Essig, but none were able to identify it with any species known to them. Consequently it is herewith described, being named *Myzocallis maureri*, after the writer's friend and classmate, Mr. L. M. Maurer of Los Angeles, California. Cotype specimens are in the author's collection under the serial number *AFS 53–15* and in the collection of the University of California.

*Alate viviparous female.*—Prevailing color light to apple green. Head, thorax, and abdomen light green. Eyes red. Prothorax apple green. Abdomen light green with margins and a small area about the base of each cornicle apple green. Beak light brown with tip dusky. Femora pale with apices dusky, tibiae dusky, tarsi and tips of tibiae black. Cornicles and cauda light green. Antennal joints I and II concolorous with head, III light brown with apical third darker, IV light brown with apical half darker, V and VI dark brown to black. Fore wings with costal and subcostal veins greenish gray, other veins light brown; costal cell hyaline; first discoidal vein broadly shaded with dark brown; second discoidal with base and tip shaded; tips of all other veins shaded, stigma hyaline with three borders (i. e., all except the outer) shaded with brown. Hind wings normal.

Antennal tubercles are small, slightly toothed on the inner side (fig. 2). First antennal segment slightly gibbous on inner side (fig. 2). Antennae considerably longer than the body, III being the longest segment, followed by IV, which is about three-fourths as long, which in turn is followed by V, being slightly more than one-half as long as III. The spur of VI is considerably longer than the base, the two being about as long as IV. On V and VI are the usual primary sensoria, and on VI the usual accessory sensoria. On III (fig. 17) there are from four to seven secondary sensoria (usually four), which are fairly large, circular and arranged in a single line along the basal one-third to one-half of the segment. The beak is short, scarcely reaching to the second coxae. Prothorax without lateral tubercles. The abdomen has about three fairly large lateral tubercles located usually on segments two, three, and four. In some specimens these are not discernible, while in others they are quite prominent. Cornicles (fig. 29) short, scarcely longer than broad at the base, and constricted in the middle. Cauda (fig. 33) slightly longer than cornicles, placed on a more or less narrow base, and with a knobbed tip. Anal plate (fig. 37) slightly more than half the length of the cauda, bilobed, the emargination being U-shaped.

Measurements: Body length, 1.445–2.125 mm. (ave. 1.955 mm.): width of thorax, .714–.85 mm. (ave. .765 mm.): antennae total, 2.363–2.703 mm. (ave. 2.473 mm.); III, .824–.969 mm. (ave. .862 mm.); IV, .459–.578 mm. (ave. .522 mm.); V, .374–.493 mm. (ave. .466 mm.); VI base, .17–.221 mm. (ave. .185 mm.); VI spur, .255–.34 mm. (.299 mm.): cornicles, .111–.17 mm. (ave. .129 mm.): cauda, .17 mm.: hind tarsus, .102–.136 mm. (ave. .119 mm.): wing length, 2.533–2.975 mm. (ave. 2.693 mm.); wing width, .799–1.105 mm. (ave. .977 mm.); wing expansion, 5.814–6.426 mm. (ave. 6.12 mm.).

**Symydobius**[5] **chrysolepis** new species (Figs. 14, 16, 30, 32, 38.)

The hills in the vicinity of Alpine, San Diego County, are dotted here and there with maul oaks (*Quercus chrysolepis*), these being quite abundant in the little ravines. In April 1916, the writer noticed a number of ants crawling along a branch of one of these small oaks. This brought his attention to a colony of brownish colored, medium-sized aphids entirely encircling a terminal twig and leaf petiole. Further observation showed many of these colonies on many of the trees in the near vicinity. A considerable number of infested twigs were gathered and later examined in the laboratory. Only apterous viviparous females could be found then, but a few days afterward several alates appeared in the colonies in the laboratory. There were also a considerable number of Chalcid parasites,[6] which had emerged from the apterae. Another examination of the trees near Alpine was made in July, but no aphids were found. Since then the writer has had no opportunity to make further observations. This species was at first thought to be *Symydobius albisiphus* Davis,[7] but, after an examination of specimens sent him, Davis stated that although they were quite similar to specimens of *albisiphus*, he considered them as distinct. Below is a table of the major points of difference in the habits and structures of the two species:

| *S. albisiphus* Davis | *S. chrysolepis* new species |
|---|---|
| Host: *Quercus alba* (a deciduous oak) | *Q. chrysolepis* (a live oak) |
| Occurrence: on under side of leaves near leaf petioles | on leaf petioles and twigs |
| Alates: Abdomen brown with a mid-dorsal whitish stripe | abdomen brown throughout |
| Body, length: ave. 1.16 mm. | ave. 1.49 mm. |
| Antennae, length: ave. .953 mm. | ave. 1.428 mm. |
| Sensoria: III, 7–8; IV, 0 | III, 6–8; IV, 1–2 |

[5] This species has been placed in the genus *Symydobius* Mordwilko only provisionally, as it is not typical of the genus. It is so closely related to *Symydobius albisiphus* Davis, however, that it has been thought best to include it in the same genus as Davis did his species. In the type species of *Symydobius* [*S. oblongus* (Heyden)] the anal plate is very indistinct or barely visible and the third antennal segment of the apterous female bears a few secondary sensoria. In this species (fig. 38) and in *S. albisiphus* Davis the anal plate is distinct and clearly bilobed, and the third antennal segment of the apterous female bears no sensoria. However, it more nearly fits *Symydobius* than any other genus known to the writer.

[6] *Closterocerus utahensis* Crawford var. *californicus* Girault. The writer is indebted to A. B. Gahan and L. O. Howard for the identification of this and other hymenopterous parasites of the aphids listed in this paper.

[7] Davis, J. J., New or little known species of Aphididae, Can. Ent. *46*: 226–231, 1914. *Symydobius albisiphus* new species.

Apterae: antennal segments differ in coloration as follows:

| *S. albisiphus* Davis | *S. chrysolepis* new species |
|---|---|
| IV, pale with tip dusky | pale with apical one-fourth dusky |
| V, pale with tip dusky | pale with apical one-half dusky |
| VI, pale with apical one-half dusky | dusky throughout |

Neither Essig nor Davidson were able to identify this species with any known to them, and it is herewith described as a new species, being named after its only known host plant, *Quercus chrysolepis*. Cotype specimens are in the writer's collection under the serial number *AFS 6–16* and in the collection of the University of California.

*Alate viviparous female*.—Prevailing color dark brown. Head dark brown eyes red. Antennal segments I and II concolorous with the head, III pale with tip dusky, IV and V pale with apical one-third dusky, VI dusky throughout. Beak brown with apex darker. Prothorax and thorax dark brown with thoracic lobes very dark brown or black. Femora and tarsi of all the legs and tibiae of the hind legs dusky. Tibiae of the first two pair of legs pale with their apices dusky. Abdomen dark brown throughout. Cornicles pale, being whitish and very conspicuous in life. (This is the character which caused the writer to believe this species to be *S. albisiphus* Davis.) Cauda and anal plate pale at the base and dusky at distal edge. Wings normal.

Head about twice as broad as long with the front flat and with no antennal tubercles. Antennae (fig. 14) shorter than body, reaching only to the fifth abdominal segment. Segment III the longest segment. IV and V subequal and about three-fourths as long as III. Base of VI slightly longer than spur, the two together being but slightly more than one-half the length of III. The usual primary sensoria are present on V and VI, together with the usual accessory sensoria on VI. On IV there are one or two fairly large, circular, secondary sensoria, although in a few specimens there are no sensoria; one is located midway between the base and the apex of the segment (fig. 14), the second, when present, midway between the first and the apex of the segment (fig. 16). There are from six to ten fairly large, circular, secondary sensoria on III (figs. 14 and 16), extending from near the base almost to the apex. The beak does not quite extend to the second coxae. The prothorax and abdomen are without lateral tubercles. The cornicles (fig. 30) are short, being but slightly longer than broad at the base, and less than half as long as the hind tarsi, and are constricted in the middle. The cauda (fig. 32) is half-moon shaped, somewhat shorter than the cornicles. The anal plate (fig. 38) is distinct and conspicuously bilobed.

Measurements: Body length, 1.41–1.56 mm. (ave. 1.49 mm.): width of thorax .714–.765 mm. (ave. .733 mm.): antennae total, 1.38–1.52 mm. (ave. 1.428 mm.); III, .391–.434 mm. (ave. .416 mm.); IV, .264–.323 mm. (ave. .304 mm.); V, .272–.323 mm. (ave. .302 mm.); VI base, .128–.170 mm. (ave. .146 mm.); VI spur, .085–.128 mm. (ave. 101 mm.): cornicles, .051–.077 mm. (ave.

.063 mm.): hind tarsus, .136–.153 mm. (ave. .145 mm.): wing length, 2.44–2.55 mm. (ave. 2.5 mm.); wing width, .918–.986 mm. (ave. .95 mm.); wing expansion, 5.1–5.6 mm. (ave. 5.4 mm.). (This description was drawn from seven individuals reared from material collected on April 22, 1916.).

*Apterous viviparous female.*—Colored throughout as in the alate. Antennae are three-fourths as long as the body, III being the longest segment, followed by IV, which is about three-fourths as long. V is either equal to or slightly shorter than IV, the latter being the usual case. The base and spur of VI are subequal, and together about the same length as V, in some specimens being slightly longer and in some slightly shorter than V. The base of VI is usually a very little longer than the spur. The only sensoria are the primary ones on V and VI, and the accessory on VI.

Measurements: Body length, 1.68–1.97 mm. (ave. 1.841 mm.): width of abdomen, 1.24–1.45 mm. (ave. 1.354 mm.): antennae total, 1.26–1.38 mm. (ave. 1.304 mm.); III, .365–.390 mm. (ave. .381 mm.); IV, .289 mm.; V, .238–.276 mm. (ave. .2482 mm.); VI base, .136–.153 mm. (ave. .1416 mm.); VI spur, .085–.102 mm. (ave. .0961 mm.): cornicles, .042–.059 mm. (ave. .052 mm.): hind tarsus, .153 mm. (This description was drawn from twelve individuals collected on April 22, 1916.)

**Nectarosiphon morrisoni** new species (Figs. 4, 28, 31, 40, 41.)

In May 1915, Harold Compere of the California State Insectary collected a number of specimens of a species of a *Nectarosiphon* from the twigs of Monterey cypress (*Cupressus macrocarpa*), in Golden Gate Park, San Francisco. He found both the alate and apterous viviparous females. In August 1916, the writer found the apterae of the same species infesting the terminal leaves of both the Monterey cypress and the blue cypress (*Cupressus guadalupensis*), in Exposition Park, San Diego. This species was studied quite extensively by Morrison, who found it again in Golden Gate Park, but who was unable to identify it with any species known to him. Neither Essig nor Davidson knew it. Consequently it is herewith described as a new species, being named after Mr. Harold Morrison of the Federal Board of Horticulture, Washington, D. C., to whom the writer here wishes to acknowledge his great indebtedness for assistance and advice. Cotype specimens are in the writer's collection and in the collection of the University of California under the serial number *EOE 88*.

*Alate viviparous female.*—Prevailing color pea green to dark green. Head dusky, eyes red. Antennal segments I and II, and the base of III concolorous with the head, remainder black. Beak green with apex dusky. Thorax green, except the thoracic lobes which are dusky-amber to black. Abdomen pea

green throughout. Legs dusky except coxae and bases of femora, which are green. Cornicles dusky with the bases green. Cauda green, faintly dusky toward apex. Wings normal, veins being dusky-amber in color.

Head (fig. 4) almost rectangular in shape, the front being flat. Antennae are set on prominent tubercles, and are about twice as long as the body. Segment VI spur is the longest segment, followed by III, V, IV, VI base, I, and II. III is about four-fifths the length of VI spur, IV slightly shorter than V, which in turn is about five-sixths as long as III. VI base is about one-fifth as long as VI spur. In but one antenna of ten examined was V as long as III, and in but one was IV as long as V. The usual primary sensoria are present on V and VI, and the usual accessory sensoria on VI. IV is without sensoria. On III (fig. 4) there are from nine to eleven circular, equal-sized, secondary sensoria arranged in a more or less even line along the basal three-fourths of the segment. The beak is fairly long, reaching to the base of the abdomen. The prothorax and abdomen are without lateral tubercles. The cornicles (fig. 31) are large, vasiform, with the tip reticulated and the rest imbricated. They are about one-third the length of the body, usually being slightly longer than segment III of the antennae. The cauda (fig. 28) is about one-half the length of the cornicles, ensiform, and with upturned tip.

Measurements: Body length, exclusive of cauda, 1.34–1.72 mm.: width of thorax, .62–.70 mm.: antennae total, 2.69–2.91 mm. (ave. 2.807 mm.); III, .55–.62 mm. (ave. .594 mm.); IV, .31–.58 mm. (ave. .474 mm.); V, .31–.62 mm. (ave. .517 mm.); VI base, .16–.22 mm. (ave. .19 mm.); VI spur, .67–.795 mm. (ave. .745 mm.): cornicles, .61–.67 mm.: cauda, .23–.31 mm.: wing length, 3.48–3.74 mm.

*Apterous viviparous female.*—These are a light yellowish to a deep rich green color, with antennae, cornicles, and legs faintly dusky. The bases of the legs are light yellow to green; the cauda is light yellow, green, or faintly dusky. Segment III (fig. 40) of the antennae sometimes has one or two small sensoria near the base. Of eighteen segments examined, ten had no sensoria, seven had one, and one had two. The antennal tubercles, cauda, and cornicles are similar to those of the alates.

Measurements: Body length, exclusive of cauda, 1.61 mm.: width at base of cornicles, .75 mm.: antennae total, 2.65 mm.; III, .61 mm.; IV, .48 mm.; V, .45 mm.; VI, base .16 mm.; VI spur, .75 mm.: cornicles, .67 mm.: cauda, .22 mm.

**Lachnus ferrisi** new species (Figs. 3, 18, 19, 25.)

In 1909, and 1910 Davidson[8] reported having found *Lachnus abietis* Fitch on *Abies concolor* (lowland fir) at Stanford University. In September 1915, G. F. Ferris found a large-sized species of *Lachnus* infesting the trunks of some young pine trees (*Pinus* sp.) at Stanford University. To the writer this species was

[8] Davidson, W. M., Notes on the Aphididae collected in the vicinity of Stanford University, Jour. Econ. Ent., *2*: 299, 1909; and Further notes on the Aphididae collected in the vicinity of Stanford University, Jour. Econ. Ent., *3*: 374, 1910.

entirely unknown, and specimens were sent to H. F. Wilson, E. O. Essig, and Harold Morrison. The first two were unacquainted with the species, and Morrison wrote as follows concerning it:

"As I suspected when I first saw your specimens, they are the same thing that Davidson called *Lachnus abietis* Fitch in his earlier papers. On comparing them with his specimens I can find only a few differences in the number of sensoria and in the relative lengths of segments IV and V of the antennae."

On the strength of this statement the writer lists *Lachnus abietis* Fitch of Davidson as a synonym of this species, which he describes herewith as *Lachnus ferrisi* new species, naming it after G. F. Ferris of Stanford University. Cotype specimens are in the writer's collection under the serial number *AFS 72–15* and in the collection of the University of California.

*Alate viviparous female.*—Prevailing color dark brown to black, slightly pruinose. Head black or dark brown, eyes red. Antennal segments I and II dusky-yellow, III dusky with the base pale, IV dusky with the basal one-half pale, V pale with the tip dusky, VI dusky except a very small area near the base which is pale. Beak pale with the two apical segments dusky. Thorax dark brown, thoracic lobes black. Abdomen dusky amber to brown with two rows of marginal black spots. Cornicles black, cauda and anal plate concolorous with the abdomen, except the distal edges which are black. Coxae dark-brown, femora luteous at bases shading into black at apices, tibiae and tarsi black. In some cases there is a narrow amber-colored ring near the base of the tibiae. This may be present on any of the tibiae, particularly on the middle; it may be present on all of the tibiae; or it may be entirely absent. This is a character that is often met with in various species of *Lachnus*. Wings normal with the veins yellowish or brownish gray, stigma gray.

Head (fig. 3) about twice as broad as long, eyes very prominent, being placed on distinct tubercles. Antennal tubercles lacking. Antennae (fig. 18) reach to the base of the thorax, and are furnished with many fairly long, stiff hairs. III is the longest segment, followed in turn by V, IV, VI, I, and II. V is a little less than one-half as long as III, IV being but slightly shorter than V. In a few cases IV is longer than V. VI is about one-half as long as IV or V, the spur being but a short thumb-like process (fig. 18), as is typical of the *Lachnini*. On V and VI (fig. 18) there are the usual primary sensoria, and on VI the usual accessory sensoria. On segment V there are, in addition to the primary sensorium, one or two secondary sensoria located in the apical one-third of the segment, not far from the primary sensorium. Usually there is but one of these secondary sensoria. Of sixteen segments examined, fourteen had but one secondary sensorium, while two had two such sensoria. On segment IV (fig. 18) there are from three to six secondary sensoria, the modal number being four. Of seventeen segments examined, three had three

sensoria, eleven had four, two had five, and one had six. On segment III (fig. 18) there are from fifteen to twenty-one secondary sensoria extending from the apex to the base. Of eighteen segments examined five had fifteen sensoria, one had sixteen, nine had seventeen, one had eighteen, one had nineteen, and one had twenty-one. The modal number of sensoria on III is therefore seventeen. These secondary sensoria are quite large, circular, and located in an even line along the segments. The beak is fairly long, reaching usually to the middle of the abdomen, although in some cases it may reach to the base of the cauda or even slightly beyond the end of the body. The cornicles (fig. 25) are quite large for *Lachnus*, being of the typical cone-shaped form. The cauda is typical, being half-moon shaped and not separated from the abdomen. The first joint of the hind tarsus is about half as long as the second joint. This is an extremely large-sized species, being about four millimeters in length and two in width.

Measurements: Body length, 3.32–5.78 mm. (ave. 3.723 mm.): width of thorax, 1.33–1.67 mm. (ave. 1.492 mm.): antennae total, 2.67–3.21 mm. (ave. 2.937 mm.); III, 1.09–1.28 mm. (ave. 1.182 mm.); IV, .5–.56 mm. (ave. .519 mm.); V, .51–.64 mm. (ave. .569 mm.); VI, .23–.28 mm. (ave. .271 mm.): width of cornicles at base, .357–.425 mm. (ave. .3825 mm.); width at apex, .102 mm.; apparent height, .187–.225 mm. (ave. .221 mm.): first joint hind tarsus, .137–.19 mm. (ave. .1632 mm.); second joint, .289–.374 mm. (ave. .3502 mm.): wing length, 5.1–5.86 mm. (ave. 5.653 mm.); wing expansion, 12.24–13.175 mm. (ave. 12.708 mm.).

*Apterous viviparous female.*—These are brown mottled with black, and slightly pruinose. The antennae are dusky, except III, which is pale with the apex dusky, and the bases of IV and V, which are pale. On III there are seven or eight large, circular sensoria on the apical one-third (fig. 19), on IV there are four, on V two, and on VI one. The one on VI and the distal one on V are the usual primary sensoria, the others being secondary sensoria. The beak is similar to that of the alate reaching beyond the middle of the abdomen to about the base of the cauda or slightly farther. The thorax and abdomen are dark brown mottled with black. The coxae are black, as well as the tibiae, the tarsi, and the femora, except the basal one-third or one-fourth, which is amber colored. The cornicles are smaller than the alates, yet conspicuous, and are black. Measurements of one specimen are: body length, 4.75 mm.: width, 2.5 mm.: antennae total, 2.94 mm.; III, 1.14 mm.; IV, .54 mm.: V, .62 mm.; VI, .25 mm.

**Lachnus taxifolia** new species (Figs. 10, 20, 26, 27.)

In August 1912, E. O. Essig collected a large number of specimens of a species of *Lachnus* on Douglass fir (*Pseudotsuga taxifolia*) in Capitol Park, Sacramento. George Shinji found the same species more or less abundantly on Douglass fir in Berkeley and in Golden Gate Park, San Francisco, throughout the spring and early summer of 1915. Specimens were sent to Davidson,

Davis and Wilson for determination. The first two reported that they were unacquainted with the species, while Wilson identified it as *L. pseudotsugae* Wilson, a species he had described from Douglass fir, in Oregon. After a careful study of a large series of specimens of this species, and a considerable number of cotype specimens of *Lachnus pseudotsugae* Wilson, the writer has come to the conclusion that they are distinct species, the California one being new and undescribed. Consequently it is herewith described as a new species, being named after its host plant, *Pseudotsuga taxifolia*. This aphid is of medium size, and is found on the older growths of the small limbs, and on the trunks of young trees, being a bark-feeder. Cotype specimens are in the writer's collection, and in the collections of E. O. Essig and of the University of California under the serial number *EOE 36*.

*Alate viviparous females.*—The body is covered with a slight pulverulence, causing it to appear quite pruinose. The ground color of the body is amber. Head dark amber, about the same width as the prothorax, or perhaps slightly narrower. Eyes black. Antennae (fig. 20) reach to the base of the abdomen, and are covered with stiff, bristle-like hairs, which arise from small but prominent tubercles. Segment I dark-amber, II dusky-yellow, III light-yellow with apex dusky, IV light-yellow with apical one-third dusky, V light-yellow with apical one-half dusky, VI dusky. The usual primary sensoria are present on V and VI, and the usual accessory sensoria on VI. Segment III has from three to seven rather large circular secondary sensoria in a more or less straight line, the first and the last slightly smaller than the others. There are one or two secondary sensoria at the apex of IV. The number of sensoria varies somewhat in the different individuals or in the two antennae of the same individual. Of twenty-two segments (III) examined three had three sensoria, four had four, eleven had five, six had six, and five had seven. Of twenty-two segments (IV) examined, nineteen had one sensorium, and three had two sensoria. Besides the primary sensorium on V, there may be one secondary sensorium, although this is not always so. The beak is dusky yellow with the apex darker, and reaches almost to the third coxae (1.1 mm. long). Prothorax with anterior half dark amber, posterior half black, about the same width as the head, or slightly wider, and with prominent lateral tubercles (.018 mm. long). Thoracic lobes black. Abdomen pruinose, the ground color being amber, with two rows of marginal black spots on each side. The cornicles (fig. 26) are short, being scarcely more than a black ring about .037 mm. in diameter. In many specimens the cornicles cannot be distinguished, but in either cleared material or specimens mounted on the side they are discernible. The cauda is well rounded, being half-moon shaped, with the distal margin dusky to black.

Anal plate with distal margin black. The body is practically bare except for bristle-like hairs on the antennae, legs, cauda, and anal plate. The coxae are black, the femora yellowish with tips dark, tibiae the same, tarsi dark. The first joint of the hind tarsus is about one-third the length of the second joint. The middle tibiae are about two-thirds as long as the hind tibiae. Wings (fig. 10) are hyaline with the costal, subcostal, and stigmal veins and the stigma grayish, and the first and second discoidal veins yellowish gray. The third discoidal is very indistinct and obsolete at the base. It is twice-branched, except in a few cases where it is but once-branched (in five out of thirty-one wings examined, it was once-branched). The first branch arises about halfway from the base to the wing margin, and the second from very near the margin to two-thirds the distance from the margin to the first branch, usually about one-half the distance. The angles of the branches are not particularly acute. Hind wings normal with yellowish gray veins.

Measurements: Body length, 2.08 mm.; width, 1.4 mm.; antennae, total, .634–.795 mm. (ave. .7672 mm.); III, .230–.305 mm. (ave. .2985 mm.); IV, .101–.137 mm. (ave. .118 mm.); V, .110–.146 mm. (ave. .1329 mm.); VI, .092–.126 mm. (ave. .1080 mm.); cornicles, diameter of opening, .037 mm.; first joint, hind tarsus, .073 mm.; second joint, .210 mm.; middle tibia, .99 mm.; hind tibia, 1.5 mm.; wing length, 5.3 mm.; width, 1.6 mm.

*Apterous viviparous female.*—The body coloring is about the same as that of the alate females. In some specimens the pulverulence is lacking, the individuals being a shiny-amber color. The antennae are colored as follows, I dark, II dusky yellow, III dusky yellow with tip dark, IV dusky yellow with apical one-half dark, V dark with base dusky yellow, VI dark. The usual primary and accessory sensoria are present, but there are no secondary sensoria. The beak is amber with base and tip dark, and reaches almost to the tip of the abdomen. The thorax is brown with black lateral longitudinal stripes. The abdomen is amber with black spots on the dorsum as in the alates, and with four black spots near the base of the cauda. The cornicles (fig. 27) are short and black, being slightly more distinct than in the alates. The coxae are black, femora amber with basal one-half dark, or amber throughout, tibiae amber with base and tip dark, tarsi dark.

Measurements: Body length, 2.00 mm.; antennae total, .715 mm.; III, .257 mm.; IV, .110 mm.; V, .119 mm.; VI, .110 mm.; cornicles, diameter of opening, .037 mm.; height, .010 mm.; first joint of hind tarsus, .073 mm.; second joint, .211 mm.

These specimens were carefully compared with cotype specimens of *Lachnus pseudotsugae* Wilson, in Essig's collection, and the following points of difference noted:

| *L. pseudotsugae* Wilson | *L. taxifolia* new species |
|---|---|
| III with 3 to 4 secondary sensoria | III with 3 to 7 sensoria (modal number being 5) |
| III almost as long as IV, V, and VI together | III scarcely as long as IV and V |

| *L. pseudotsugae* Wilson | *L. taxifolia* new species |
|---|---|
| Beak reaching distinctly beyond third coxae | Beak reaching scarcely to third coxae |
| Cornicles normal, being quite conspicuous | Cornicles scarcely discernible |
| First joint of hind tarsus not quite one-third the length of the second | First joint of hind tarsus equal to or longer than one-third the length of the second |
| Angles of branches of the third discoidal very acute | Angles of branches of third discoidal not particularly acute. |

The difference in the relative lengths of the third antennal segment, the great difference in the cornicles, and the difference in the lengths of the beaks are sufficient characters in the writer's opinion to warrant a separation of species.

**Aphis ramona** new species (Figs. 5, 11, 22, 23.)

There came to the writer's hands several specimens of a species of *Aphis* taken by E. O. Essig and S. H. Essig, county horticultural inspector of Ventura County, on black sage (*Ramona stachyoides*, at Nordhoff, Ventura County, August 1911, and at Santa Paula, April 1913. Concerning its habits Essig merely notes, "Attacks black sage, more or less heavily parasitized, attended by ants to a large extent." The species does not agree with any known to the writer, nor to Essig or Davis, both of whom examined specimens, consequently it is herewith described as a new species, being named *Aphis ramona*, after the generic name of its only recorded host plant. Cotype specimens are in the private collection of E. O. Essig, in the private collection of the writer, and in the collection of the University of California under the serial number *EOE 12*. The color notes in the following description are taken from those of E. O. Essig.

*Alate viviparous female.*—Prevailing color green and dark-brown, the head being dark-brown, with a distinct tubercle at the apex of the front and small but distinct antennal tubercles (fig. 5). The eyes are red. The antennae (fig. 11) are dusky brown throughout, except the tip of V and all of VI, which are slightly paler. Segment III is the longest segment, the spur of VI next, followed by IV and V which are subequal, but slightly shorter than the spur of VI and about one-third the length of III. I and II are subequal and about two-thirds the length of the base of VI. The usual primary sensoria are present on V and VI and the accessory on VI. Segment IV has from one to four fairly large, circular, secondary sensoria, placed in a more or less even row along the

distal half. Of twenty segments examined, two had one sensorium, eight had two sensoria, seven had three, and three had four sensoria. On segment III there are from ten to seventeen secondary sensoria scattered irregularly along the entire length of the segment. Of twenty segments examined, two had ten sensoria, three had eleven, five had twelve, three had thirteen, three had fourteen, one had fifteen, two had sixteen, and one had seventeen. The thorax is brown, with the lobes almost black. A pair of small but distinct lateral tubercles is present on the prothorax. The abdomen is green, with dark markings in the form of cross bands and spots on the dorsum. Lateral tubercles are present on the first and seventh segments. The cornicles (fig. 22) are brown, distinctly imbricated, almost cylindrical, and about equal in length to segments IV or V of the antennae, being considerably shorter than III. The cauda (fig. 23) is ensiform, light brown, with the distal end slightly darker, a little more than half the length of the cornicles and about the same length as the hind tarsi, or perhaps slightly longer. The legs are pale, with the coxae, tarsi, apical two-thirds of the femora, and apices of the tibiae dusky. The wings are normal, hyaline, stigma light brown or amber, veins brown.

Measurements: Body length, .98 mm.: width of thorax, .48 mm.: antennae total, .81 mm.; III, .20–.23 mm.; IV, .14 mm.; V, .12–.14 mm.; VI base, .08 mm.; VI spur, .15 mm.: cornicles, .14 mm.: cauda, .08 mm.: hind tarsus, .08 mm.: wing length, 2.07–2.11 mm.; wing width, .780–.810 mm.

*Apterous viviparous female.* Prevailing color a rich dark green with head dusky brown. Eyes are red. Antennae are dusky brown throughout, reaching to the base of the cornicles, with only the usual primary and accessory sensoria present. Segment III is the longest segment, with IV, V, and the spur of VI following, all of which are subequal, or in some cases with IV slightly the longest, V being next. I and II are subequal and slightly shorter than the base of VI. Very small but fairly distinct antennal tubercles are present. The beak is light green, with the tip dusky, and reaching to the middle of the third coxae. The thorax and abdomen are rich green without dorsal markings. Lateral tubercles are present on the prothorax and on the first, second, and seventh abdominal segments. The cornicles are concolorous with the abdomen, or very slightly darker, with the tip dusky, tapering slightly from base to apex and about as long as segment III of the antennae. The cauda is about one-half the length of the cornicles, being about one-half as long again as the hind tarsi, ensiform, concolorous with the abdomen, or with the distal end slightly dusky. The anal plate is dusky and half-moon shaped. The legs are pale with the coxae, tarsi, and tips of the tibiae dusky.

Measurements: Body length, 1.14 mm.: width of thorax, .67 mm.: antennae total, .95 mm.; III, .25–.26 mm.; IV, .17–.19 mm.; V, .16 mm.; VI base, .09 mm.; VI spur, .14 mm.: cornicles, .25 mm.: cauda, .12 mm.

**Aphis senecio** new species (Figs. 6, 12, 21, 24.)

This is a very common species throughout central and southern California, and has been reported several times as *Aphis bakeri* Cowen.[9] Davidson's description of *Aphis* sp. (1909) probably is also of this species. Concerning this Davidson writes: "I think the species on *Senecio mikanioides* was the same as on the other plants, but there might have been more than one species on the host." Although this species was considered for a long time to be *Aphis bakeri* Cowen, the fact that it was never found on apple or other deciduous trees where *A. bakeri* is supposed to pass the winter, as well as the fact that it never seemed to have any particular liking for clover, on which *A. bakeri* is described as being a considerable pest, led the writer to believe that it was not this species, but some other. Davidson writes that he has noticed this and is of the same opinion. Morrison was also doubtful, although neither he nor Davis were able to detect any structural differences. Gillette stated that he has specimens from Davidson, and that he does not consider it to be *Aphis bakeri* Cowen, as it differs particularly in habits, and structurally in the length of the beak. Below is an extract from a letter from Davidson concerning this species.

"Williams' *Aphis senecionis* appears to be closely related but is obviously different in the sensoriation and other points. None of Williams' other Compositae species appear to approach this species. The first host upon which I took it was the common groundsel, which, I believe, is an imported European species. This might point to its occurrence in Europe, but I am unable to fit it to any European species. I think you are justified in giving it a name, as no American aphidologist has been able to determine it for surety."

The species has been taken throughout the San Francisco Bay region and throughout southern California on a large number of host plants, particularly *Compositae*. At present there are about twenty-two host plants, belonging to sixteen genera

[9]Davidson, W. M., Notes on the Aphididae Collected in the Vicinity of Stanford University, Jour. Econ. Ent., *2:* 302, 1909, *Aphis* sp., desc.; Davidson, W. M., Further Notes on the Aphididae Collected in the Vicinity of Stanford University, Jour. Econ. Ent., *3:* 377, 1910, *A. bakeri* Cowen (?), list; Davidson, W. M., Plant Louse Notes from California, Jour. Econ Ent., *7:* 133, 1914, *A. bakeri* Cowen, list; Essig, E. O., Insects of California, Cal. Com. Hort., 87, 1915, *A. bakeri* Cowen, list.

and six families. According to Davidson "on German ivy it seems to exist the year around, the annuals being infested by migrants from it." The writer has noticed this in the San Francisco Bay region, but in Southern California it is found during the winter, particularly on asters and marigolds. When the hot weather of the summer in the south begins, it seems to disappear, not being found again until fall. In the early part of the year (January and February) the alates are most common, the apterae appearing later. Following is a list of the host plants and collection records:

### Food Plants

*Salicaceae.* Willow family.

*Salix* sp. (willow). Berkeley, Essig, 1915.

*Polygonaceae.* Buckwheat family.

*Rumex* sp. (dock). Stanford University, March, 1915, apterae.[10]

*Leguminaceae.* Pea family.

*Cytisus proliferus* (broom). Berkeley, Essig, 1915.

*Malvaceae.* Mallow family.

*Abutilon* sp. (Indian mallow). Stanford University, February, 1915, apterae.

*Boraginaceae.* Borage family.

*Ambrosia psilostachya* (western ragweed). Berkeley, Essig, 1915.
*Amsinckia* sp. Stanford University, Davidson, 1909.
*Amsinckia intermedia* (buckthorn weed). Stanford University, Morrison, 1912.
*Amsinckia spectabilis.* Berkeley, Essig, 1915.

*Compositae.* Composite family.

*Anthemis* sp. (chamomile). San Francisco Bay region, Davidson, 1914.
*Artemesia* sp. (sagebrush). San Francisco Bay region, Davidson, 1914.
*Artemesia californica* (old man). Berkeley, Essig, 1915.
*Artemesia heterophylla* (California mugwort). Berkeley, Essig, 1915.
*Aster,* cultivated. San Diego, January, 1916, alate; Ontario, San Bernardino County, January, 1917, alate.
*Baccharis pilularis* (chapparal broom). Berkeley, Essig, 1915; Stanford University, Ferris, 1916.
*Calendula officinalis* (marigold). Berkeley, Essig, 1915; San Diego, March, 1916, apterae; Riverside, February, 1917, alate; Orange, Orange County, February, 1917, alate and apterae.

[10] In references where no collector's name is given the collection was made by the writer.

*Chrysanthemum* cultivated. Berkeley, Essig, 1914; Menlo Park, San Mateo County, March, 1915, apterae; Berkeley, October, 1915, alate and apterae; San Diego, January, 1916, alate; La Jolla, San Diego County, February, 1916, apterae; Ontario, San Bernardino County, January, 1917, apterae.

*Gnaphalium* sp. (everlasting). Walnut Creek, Contra Costa County, Davidson, 1914.

*Grindelia cuneifolia* (marsh grindelia). Walnut Creek, Contra Costa County, Davidson, 1915.

*Helianthus* sp. (sunflower). San Francisco Bay region, Davidson, 1914.

*Senecio* sp. (German ivy). Stanford University, Davidson, 1909; *ibid*, 1914; Palo Alto, Santa Clara County, February 1915, apterae.

*Senecio mikanioides* (ivy senecio). Stanford University, Davidson, 1909 (?); Berkeley, Essig, 1915.

*Senecio vulgaris* (common groundsel). Stanford University, Davidson, 1910; Santa Paula, Essig, 1911.

Following is a description of this species under the name of *Aphis senecio* new species. Cotype specimens are in the writer's collection and in the collections of E. O. Essig and the University of California.

*Alate viviparous female.*—The prevailing color is pale green with the head, thoracic lobes, and markings on the dorsum of the abdomen olive green to black. The head (fig. 6) is olive green to black, almost triangular with a distinct tubercle at the apex of the frons. Antennal tubercles are absent. Eyes are red. The antennal formula is as follows: III, VI spur, IV, V, VI base, I, and II. Segments V and VI have the usual primary and accessory sensoria. On III there are fairly large, circular secondary sensoria, arranged irregularly along the whole length of the segment, and in such numbers as to cause the segment to appear tuberculate (fig. 12). Four specimens from *Chrysanthemum* (Berkeley, October 1915) had the following number of sensoria: 20, 23, 24, 24, 25, 25, 26, 27, Three specimens from *Senecio* (Essig, Berkeley, 1915) had 20, 22, 22, 22, 22, 23. Five specimens from *Amsinckia* (Morrison, Stanford University, 1912) had 19, 21, 21, 21, 22, 22, 22, 23, 23, 24. Two specimens from *Baccharis* (Stanford University, Ferris, 1916) had 21, 21, 23, 24. The modal number of sensoria appears to be 22 or 23. The secondary sensoria on IV are of various sizes, ranging from very small to almost as large as those on III. They are arranged in a more or less even row, and quite irregularly. Of twenty-five segments examined (the same specimens as above for III) two had one sensorium, two had two sensoria, nine had three, five had four, two had five, four had six, and one had seven sensoria. The modal number appears to be three or four. The thorax is dull green with the lobes very dark olive brown or black. Small lateral tubercles are present on the prothorax. The beak is pale at the base and dark green at the apex, and reaches distinctly beyond the second coxae, in fact almost to the third coxae. In some cases it even reaches to the middle of the third coxae. In this character

is found the chief structural difference between this species and *Aphis bakeri* Cowen, for in the latter the beak "barely reaches to the second coxae." The writer has just recently had opportunity to examine specimens of *Aphis bakeri* Cowen, from clover and apple in Utah, taken by R. W. Doane during the summer of 1916, and has noted the quite striking difference between the beaks of this and *Aphis senecio* new species. The abdomen is dull pale green with dorsal black markings in the form of blotches or spots. The cornicles (fig. 21) are short and dark, and tapering slightly, but with the apex somewhat flanged. The cauda (fig. 24) is short with the distal end dusky, about the same length as the cornicles. The cornicles, cauda, and hind tarsi are subequal in length. The coxae are black, the femora black or dusky with the basal one-fourth to one-third pale, the tibiae greenish with the apical one-fifth to one-fourth black or dusky, the tarsi are black. The wings are of normal size and venation, being hyaline. The veins are light brown, the stigma grayish brown.

Measurements: Body length, 1.17–1.25 mm.: width of thorax, .47–.48 mm.: antennae total, 1.09–1.34 mm.; III, .31–.39 mm.: IV, .19–.23 mm.: V, .13–.16 mm.; VI base, .08–.11 mm.; VI, spur, .23–.36 mm.: cornicles, .09–.11 mm.: cauda, .08–.09 mm.: hind tarsus, .09–.11 mm.; wing length, 2.2–2.7 mm.; wing width, .87 mm. The spur of segment VI is slightly shorter than III in most cases, although in some it is equal to III, but never longer.

*Apterous viriparous female.*—Prevailing color pale green with head, prothorax, antennae, legs, and cornicles almost luteous. The tip of segments V and all of VI are dusky. The cauda is pale green. The cornicles and cauda are of the same shape as those of the alates. The beak is similar to that of the alates, being pale with the apex dusky, and reaching distinctly beyond the second coxae and even to the middle of the third coxae. The usual primary and accessory sensoria are present on V and VI, but no secondary sensoria are found.

Measurements: Body length, 2.21 mm.: width of thorax, 1.07 mm.: antennae total, 1 mm.; III, .24 mm.; IV, .17 mm.; V, .11 mm.; VI, base, .11 mm.; VI spur, .22 mm.: cornicles, .11 mm.: cauda, .08 mm.: hind tarsus, .09 mm.

**Cerosipha**[11] **cupressi** new species (Figs. 7, 8, 9, 13, 39.)

In April 1916, the writer observed a few specimens of a very small green aphid on the terminal twigs of blue cypress (*Cupressus guadelupensis*) in Exposition Park, San Diego. Only the small apterous females could be found. These were very remarkable because of their very convex abdomen, conspicuous

[11] This species does not fit exactly into either *Sipha* or *Cerosipha*, on account of the atrophied cornicles. The description of *Cerosipha* is very brief and may be extended to include a species with such atrophied cornicles. Following is a copy of Del Guercio's original description of the genus, which was published in 1909 (?) in NOUVE RELAZIONI R. STAZIONE ENTOM. AGRARIA,

cauda, and atrophied cornicles. Again in August 1916, the author took a number of specimens of the species from *Cupressus guadelupensis* and *C. macrocarpa* (Monterey cypress) in San Diego. A few alate females were reared in the laboratory. On the Monterey cypress this species was accompanied by specimens of *Nectarosiphon morrisoni* new species (see above). In January 1917, it was again observed on blue cypress, this time in White Park, Riverside. The writer kept this infestation under observation for several months. It was noted that the apterae were found singly at the base of the terminal leaves. The alates were very scarce and were obtained only by placing infested branches in closed receptacles. This leads to the view that they undoubtedly migrate to some other host. A large percentage, probably as high as forty per cent, of the apterae were parasitized by a small *Braconid*[12] fly. Other species of *Cupressus* have been carefully examined by the writer, but, with the exception of these two, he has not found any infested with this little aphid, nor has he ever seen any aphid similar to it on another kind of plant.

FIRENZE—Serie Prima—No. 2, page 116. This reference and description was obtained through the kindness of H. F. Wilson of the University of Wisconsin.

"Gen. XXV. *CEROSIPHA*, Del Guercio.

"Antennae breves quinquearticulate, articuli quinti processus terminalis setaceus tertium subequans. Nectaria cylindrica.

"SYNOPSIS SPECIERUM.

"Species unica. 1. *Cerosipha Passeriniana.*

"REVISIO SPECIERUM.

"1. *Cerosipha Passeriniana*, Del. G.

"La specie prende nome de quello del Sig. Conte Prof. H. Passerini, di Firenze, che me l'ha gentilmente communicata. Si trova con le femmine attere nella pagina inferiore delle foglie della *Salvia splendens*, di primavera, Perugia, Maggio 1899."

The writer is unacquainted with the type species, as well as with the one previously known American species of this genus, *Cerosipha rubifolii* Thomas, but believes that the species here in question fits this genus nearer than it does *Sipha*, particularly in the relative lengths of the third antennal segment and the spur of the sixth. This species is very odd, however, and could well be placed in a separate genus.

[12] This was determined by A. B. Gahan to be an undescribed species of *Trioxys*.

It is described herewith as a new species, naming it after its host plant, *Cupressus* spp. Cotype specimens are in the writer's private collection under the serial numbers *AFS 36–16* and *AFS 2–17* and in the collection of the University of California under the serial number *AFS 2–17*.

*Alate viviparous female.*—Prevailing color dark green and black. Head and thorax very dark green to black. Antennal segments I and II concolorous with the head, III green with dusky apex, IV, V, and spur dusky. Beak green with apex dusky. Wings normal with grayish veins and grayish-green stigma. The coxae are dusky, femora green with the apical one-half of the hind pair in some specimens darker green, and in other specimens with all three pairs green with apices only darker, tibiae green with apices dusky, tarsi dusky. Cauda and anal plates dark green.

Head (fig. 8) rectangular, front flat, no antennal tubercles. Antennae (fig. 13) short, scarcely reaching to the base of the abdomen, five-segmented. Segment III and V are subequal, or III slightly longer. This character takes this species out of the genus *Sipha*, and places it more nearly into *Cerosipha* in which III and V are subequal (see note 11, pages 19 and 20). In two antennae examined V was slightly longer than III, but in all other cases III was either equal to or slightly longer than V. The base and spur of V are subequal, or the spur a little longer. Segment IV is equal to or somewhat longer than the base of V. On V are present the usual primary sensorium and the small accessory sensoria. On IV there is always one sensorium at the apex (primary sensorium?) and from one to three secondary sensoria located in the apical one-half. Usually there is but one which is located about the middle of the segment. On III there are from five to eight (usually six) fairly large, circular, secondary sensoria, arranged in an even line from base to apex. From the sensoriation it would appear that segments IV and V correspond to V and VI of the typical Aphidid antennae, while III corresponds to III and IV. The beak is short, reaching only to the second coxae. The prothorax and abdomen are without lateral tubercles, in so far as could be determined from the specimens on hand. The wings (fig. 9) are normal, with normal Aphidine venation. The second branch of the third discoidal is nearer to the tip of the wing than to the base of the first branch, somewhat as in *Aphis avenae* Fabr. and *Aphis salicicola* Thomas, although perhaps not quite so marked. The cauda (fig. 39) is long, ensiform, and quite conspicuous, being slightly more than one-eighth the length of the body, and one-half as long again as the hind tarsi. The cornicles are atrophied, being merely pores, and very hard to distinguish. In most of the writer's material it is impossible to see them, but in a few specimens, mounted on the side and cleared considerably, the pores can be made out.

Measurements: Body length, .986–1.275 mm. (ave. 1.122 mm.): width of thorax, .561–.629 mm. (ave. .578 mm.): antennae total, .493–.616 mm. (ave. .583 mm.); III, .153–.238 mm. (ave. .204 mm.); IV, .085–.127 mm. (ave. .109 mm.); V, .187–.204 mm. (ave. .197 mm.): cauda, .144–.170 mm. (ave. .158 mm.):

hind tarsi, .102–.119 mm. (ave. .115 mm.) wing length, 1.7–1.82 mm. (ave. 1.761 mm.); wing width, .561–.765 mm. (ave. .694 mm.); wing expansion, 3.70–4.23 mm. (ave. 4.05 mm.).

*Apterous viviparous female.*—Prevailing color pale yellowish-green, shiny. Eyes black. Antennae, beak except apex, and legs except tarsi, tips of tibiae, and distal one-half of hind femora, pale. Cauda, apex of beak, tarsi, tips of tibiae and femora, and apical one-half of hind femora dusky. Abdomen very convex (fig. 7), in life being as high as it is wide. Cauda not visible from above in living specimens, although in mounted material it is very conspicuous. Antennae are short, reaching only to the mesathorax, beak barely reaching second coxae. Abdomen without lateral tubercles in so far as can be discerned. Cornicles merely pores. The great convexity of the abdomen (fig. 7) is a distinguishing character.

Measurements: Body length, 1.15–1.29 mm. (ave. 1.244 mm.): width of abdomen (mounted), .85–1 mm. (ave. .92 mm.); height of abdomen (mounted), .85–1.03 mm. (ave. .91 mm.): antennae total, .51–.54 mm. (ave. .52 mm.); III, .136–.170 mm. (ave. .15 mm.); IV, .093–.102 mm. (ave. .097 mm.); V, .17–.204 mm. (ave. .19 mm.): cauda, .187–.204 mm. (ave. .195 mm.): hind tarsi, .119 mm.: diameter of cornicle at base, .035 mm.; diameter of opening, .021 mm.

## Figures

All drawings made with the camera lucida, and on the same scale, except numbers 7, 9, and 10, which are drawn with a smaller magnification. The 25 mm. ocular and 16 mm. objective used throughout.

Fig. 1.—*Myzocallis davidsoni* new species. Head, alate.
Fig. 2.—*Myzocallis maureri* new species. Head, alate.
Fig. 3.—*Lachnus ferrisi* new species. Head, alate.
Fig. 4.—*Nectarosiphon morrisoni* new species. Head, alate.
Fig. 5.—*Aphis ramona* new species. Head, alate.
Fig. 6.—*Aphis senecio* new species. Head, alate.
Fig. 7.—*Cerosipha cupressi* new species. Aptera—side view.
Fig. 8.—*Cerosipha cupressi* new species. Head, alate.
Fig. 9.—*Cerosipha cupressi* new species. Distal portion of wing.
Fig. 10.—*Lachnus taxifolia* new species. Distal portion of wing.
Fig. 11.—*Aphis ramona* new species. Antennal segments III and IV, alate.
Fig. 12.—*Aphis senecio* new species. Antennal segments III and IV, alate.
Fig. 13.—*Cerosipha cupressi* new species. Antenna, alate.
Fig. 14.—*Symydobius chrysolepis* new species. Antenna, alate.
Fig. 15.—*Myzocallis davidsoni* new species. Antennal segment III, alate.
Fig. 16.—*Symydobius chrysolepis* new species. Antennal segment III and IV, alate.
Fig. 17.—*Myzocallis maureri* new species. Antennal segment III, alate.
Fig. 18.—*Lachnus ferrisi* new species. Antenna, alate.
Fig. 19.—*Lachnus ferrisi* new species. Antenna, aptera.
Fig. 20.—*Lachnus taxifolia* new species. Antenna, alate.
Fig. 21.—*Aphis senecio* new species. Cornicle, alate.
Fig. 22.—*Aphis ramona* new species. Cornicle, alate.
Fig. 23.—*Aphis ramona* new species. Cauda, alate.
Fig. 24.—*Aphis senecio* new species. Cauda, alate.
Fig. 25.—*Lachnus ferrisi* new species. Cornicle, alate.
Fig. 26.—*Lachnus taxifolia* new species. Cornicle, alate (top view).
Fig. 27.—*Lachnus taxifolia* new species. Cornicle, aptera (side view).
Fig. 28.—*Nectarosiphon morrisoni* new species. Cauda, alate.
Fig. 29.—*Myzocallis maureri* new species. Cornicle, alate.
Fig. 30.—*Symydobius chrysolepis* new species. Cornicle, alate.
Fig. 31.—*Nectarosiphon morrisoni* new species. Cornicle, alate.
Fig. 31.—*Symydobius chrysolepis* new species. Cauda, alate.
Fig. 33.—*Myzocallis maureri* new species. Cauda, alate.
Fig. 34.—*Myzocallis davidsoni* new species. Cornicle, alate.
Fig. 35.—*Myzocallis davidsoni* new species. Cauda, alate.
Fig. 36.—*Myzocallis davidsoni* new species. Anal plate, alate.
Fig. 37.—*Myzocallis maureri* new species. Anal plate, alate.
Fig. 38.—*Symydobius chrysolepis* new species. Anal plate, alate.
Fig. 39.—*Cerosipha cupressi* new species. Cauda, alate.
Fig. 40.—*Nectarosiphon morrisoni* new species. Antennal segment III, aptera.
Fig. 41.—*Nectarosiphon morrisoni* new species. Antennal segment III, alate.

# NEOTROPICAL BEES, PRINCIPALLY COLLECTED BY PROFESSOR BRUNER IN ARGENTINA

BY T. D. A. COCKERELL

Many years ago Professor L. Bruner visited Argentina to report on the injury caused by locusts in that country, and while there, took occasion to collect bees. Most of his material came from Carcaraña, which is, as I learn from Professor Bruner through Professor Swenk, twenty or thirty miles west of Rosario, on the main railroad line. It is, therefore, not in the western part of the country, as I had supposed, but is over 400 miles east of Mendoza, the locality made famous by the collections of Jörgensen and others.

At the time when Professor Bruner made his collection, probably not less then eighty or ninety per cent of the species were new, but since that time many bees from Argentina and Paraguay have been described, principally by Holmberg, Friese, Jörgensen, Schrottky, Brethes and Strand. It appears, however, that no one has collected extensively, if at all, in the Carcaraña district, and consequently many new species are still to be found among Professor Bruner's captures. These species are probably for the most part very local, or confined to particular plants, just as we find to be the case in our own southwestern country. Travelling from New Mexico through Arizona into California we meet with several different bee-faunæ, with often representative but quite distinct species. Some species, of course, range over the whole area. The same seems to be true in Argentina, and the Carcaraña fauna resembles (and differs from) that of Mendoza much as that of New Mexico does that of Southern California.

The species of bees may spread over large areas, and then break up into races and eventually species as they become adjusted to local conditions, especially to particular plants. A wide-spread species has better chances for survival, *as a species*, than a local one, but it is of no advantage to an individual bee to belong to a wide-spread species. Its problem is rather adjustment to the immediate surroundings, and in this respect it may be

less fit than a local or endemic form. Yet, if it becomes oligotropic, and anything happens to the necessary plant or plants, the species is in danger, whereas a loosely adapted form suffers no inconvenience.

Dr. J. C. Willis has recently written much on the distribution of flowering plants, urging that the most local species are generally those of most recent origin, whereas the older they are, the wider will be the range. Naturally there are many exceptions, such as that of the *Sequoia* species in California. Among the bees, it is doubtless true that the precinctive species are nearly always endemic,—that is, they have arisen in the general region where we find them, and have not been formerly much more widespread. Whether the wide-spread species are necessarily old, may well be another matter. A species with strong flight or migratory instincts may spread over a very large area in a short time, as we see in the case of introduced insects. The evolution, or as it were liberation, of a species capable of spreading widely from a relatively local type may well follow the natural lines of advantage at the boundaries of the original species-area; but it is probably more common for the new adaptations to lead to other species just as specialised, but living different lives. Doubtless the very resistance to modification, the stability of type seen in such butterflies as *Euvanessa antiopa*, *Pyrameis cardui* and *atalanta*, has had something to do with their wide range. They could not follow the path of local adaptation, being without the necessary variability; hence there was no conflict between the two different tendencies. Thus it appears that the range of a species has more to do with its variability than its age. There are, indeed, especially among the bees, some species said to be very wide-spread and very variable. Whenever I have been able to get good series of such forms from different localities (e. g. in *Crocisa* and *Xylocopa*) I have found that they were compósite, and consisted in fact of numerous local species which had been lumped together. In the older collections, with frequently slight indications of localities, the long series gathered together from many places give the impression of single species showing an enormous range of variation.

The Bruner collection of Argentine bees was divided, a set going to the U. S. National Museum, and one remaining at the University of Nebraska. It is the National Museum set which is here described, and I have added a certain number of other neotropical forms, also in the National Museum, the types of all the new species being in the collection of that institution.

**Dasiapis tropicalis** new species

Female. Length, 10 mm., anterior wing, 7.2 mm.; clypeus black; mandibles largely creamy white; flagellum bright ferruginous beneath; mesothorax and scutellum entirely dull; tegulae testaceous; wings dusky hyaline; abdomen covered with appressed pale ochraceous hair, margin of fifth segment and apex with pale yellowish-ferruginous hair; scopa of hind legs very pale ochreous; hind basitarsi with hair on inner side ferruginous.

Pueblo Viejo, Vera Cruz, Mexico, Dec. 8, 1909 (F. C. Bishopp). Differs from *D. olivacea* Cresson by being larger, and having pale red hair (instead of fuscous) at apex of abdomen. Very close to *D. ochracea* Cockerell, but with shorter, dusky wings, redder hair on tarsi; and abdomen not quite so densely hairy. The third and fourth joints of maxillary palpi are fringed with long hair. It is possibly a subspecies of *D. ochracea*, but intermediates are not at present known.

**Xenoglossa rhodophila** new species

Female. Length, 14 mm., anterior wing, 10.3 mm.; robust, black; eyes dark brown; facial quadrangle broader than long; mandibles simple, curved, reddish at tip; clypeus densely rugosopunctate, elevated in middle; antennae dark, joints six to eleven with suffused red spots or areas on outer side; third antennal joint as long as next two combined; ocelli in a line; hair of head white (very long on cheeks) except on vertex and front where it is thin and dark grey; mesothorax shining, well punctured; scutellum with extremely dense small punctures; hair of sides of thorax and metathorax white; dorsum of thorax with a broad band of black hair across mesothorax, bounded in front and behind by dull white; middle of scutellum with dark hair; tegulae piceous; wings dusky subhyaline; first recurrent nervure joining second submarginal cell near end; legs with pale hair, fuscous on inner side of tarsi; abdomen with hind margins of segments testaceous (narrowly on first); first segment hairy at base, but otherwise bare; second bare, with minute punctures; remaining segments covered with pale fulvous hair, the fourth with a beautiful golden fringe. The type has collected a quantity of deep red pollen.

Mexico (Baker coll. 2386). Allied to *X. fulviventris* (*Tetralonia fulviventris* Smith), but distinguished by the bare second abdominal segment, white hair on head and thorax, etc. The blade of maxilla is much larger than in *fulviventris*. The venation is not that of typical *Xenoglossa*.

**Thygater bifasciata buccosa** (Vachal)

Female. Carcaraña, Argentina (Bruner, 20). The thorax above has bright fox red hair. The abdomen has three broad shining golden bands; these are due to white tomentum at bases of segments three to five, overlapped by the broad hyaline margins of segments two to four, on which are appressed golden hairs. The mesopleurum is black haired. The third joint of maxillary palpus is a little larger than second. In this species the hair of the thorax above varies from fuscous (typical *bifasciata* Smith) to fuscous in front and fulvous behind (var. *nigricollis* Vachal) or entirely fulvous (var. *buccosa* Vachal). The variety *chrysophora* (Holmberg) is like *bifasciata*, but has three bands on the domen instead of two.

**Thygater bruneri** new species

Female. Length, 12 mm., anterior wing, 9.5; black, robust, the mandibles reddish beyond base, and with a broad orange stripe on apical part; labrum black; maxillary palpi three-jointed, the last two joints about equal in length; clypeus strongly punctured, not at all keeled; facial quadrangle broader than long; face and region of antennae with dull white hair, the narrow cheeks also with white hair, but occiput, vertex and sides of front with black hair; flagellum bright ferruginous beneath, the apical margins of joints blackened above; third antennal joint 610 microns long; hair of thorax above largely bright fox-red, but a narrow black fringe anteriorly, posterior disc of mesothorax and anterior half of scutellum with black hair; mesopleura with black hair, but sides of metathorax with pale fulvous; tegulae clear rufotestaceous; wings dusky; second submarginal cell oblique, receiving first recurrent nervure about half-way between middle and end; third submarginal very abruptly angled on outer side; legs black, the small joints of tarsi dull ferruginous; anterior and middle legs with mainly black hair, but some white hair on outer side of base of anterior tibiae, hair on inner side of anterior tibiae and tarsi red, middle basitarsi with pale hair basally in front; hind tibiae and basitarsi with long plumose white scopa, but basitarsi with black hair at apex and on inner side; abdomen with hind margin of first segment very narrowly pallid, but the other segments dark to apex; first segment with loose fulvous hair, lacking on apical part; second with pale fulvous appressed hair, lacking on apical margin, and divided by a transverse narrow median hairless band; third and fourth segments each with a very broad band of pale fulvous tomentum, not covering margin on third; apex and fifth segment with black hair.

Carcaraña, Argentina (Bruner 13). Known by the dark margins of abdominal segments from *T. bifasciata* of the same region. According to Bertoni and Schrottky, *Melissodes nigroaenea* Smith sometimes has three-jointed maxillary palpi, and a

specimen determined as *nigroaenea* by Schrottky is very similar to *T. bruneri*, differing, however, by the shorter face, the light hair of mesopleura, and the deeper marginal cell. Neither *T. bruneri* nor the Schrottky specimen agree with Smith's description of *M. nigroaenea* from Brazil, though that description does suggest a *Thygater*. *Ecplectica tintinnans* Holmberg, which has been regarded as a synonym of *M. nigroaenea*, has the maxillary palpi four-jointed, the second joint much longer than the third. Bruner's 64, 29 and 89 I regard as *M. nigroaenea tintinnans;* it is quite distinct from *T. bruneri*.

**Thygater pygialis** (Buysson)

Males from Colombia (Baker collection). It was described from Venezuela. The flagellum is black, and the thoracic dorsum has the hair mainly pale fulvous or whitish, but blackish or grey anteriorly. The yellow hair on apical part of abdomen shines golden.

**Temnosoma smaragdinum** Smith

Cordoba, Vera Cruz, Mexico, Jan. 20. (F. Knab.)

**Anthophora paranensis** Holmberg

Carcaraña, Argentina (L. Bruner 11).

**Centris nigriventris** Burmeister

Carcaraña, Argentina (Bruner 7).

**Xylocopa melanura** new species

Female. Robust, black, with black pubescence; outer side of middle and hind tarsi, and apex of hind tibiae, with cream-colored hair; wings brown, only moderately dark, scarcely metallic; second recurrent nervure joining third submarginal cell not far from base; length of anterior wing, 13.5 mm.; antennae dark; clypeus closely and strongly punctured; abdomen with a weak median carina beneath.

Mexico (no other particulars known). I do not describe this more fully, as it has the structure of *X. tabaniformis* Smith, of which it is perhaps only a local race. It is easily distinguished from *tabaniformis* by the absence of light hair-bands on the abdomen. It looks like a large Anthophorid.

**Melissodes bimaculata morrilli** new subspecies

Female. Differs from *M. bimaculata* by having the broad depressed apical parts of second and third abdominal segments dullish (not polished), with very minute and remote punctures; tegulae with a ferruginous spot posteriorly.

Tlahualilo, Durango, Mexico, at flowers of squash, Sept. 2, 1904 (A. W. Morrill). Also one from Mexico (Baker coll. 2320). The first mentioned is the type. The black hair of the head readily distinguishes this from *M. atrata* Smith, which is otherwise very similar.

**Melissodes albocollaris** new species

Male. Length, about 13 mm.; very robust; black, including tegument of clypeus and labrum; mandibles with an orange band on apical part; antennae reaching to base of abdomen, flagellum very bright ferruginous beneath; third antennal joint much longer than broad; eyes greenish, prominent; facial quadrangle distinctly longer than broad; vertex shining; mesothorax and scutellum polished, with coarse punctures; spurs ferruginous; tegulae black, with pale hair; wings dilute fuliginous; second submarginal cell very broad, receiving first recurrent nervure well beyond middle; hair of head white or pale ochreous, but black on vertex and occiput; hair of thorax black, but creamy white on upper margin of prothorax, tubercles, broad anterior border of mesothorax and long fringe along posterior margin of scutellum; abdomen with thin black hair, but with some inconspicuous pale hair at sides, more abundant and forming large thin patches on segments four and five; venter with black hair.

Mexico (Baker coll. 2154). Related to *M. atrifera* Cockerell, but very robust, with hair of pleura and metathorax black.

**Melissodes atramentata** new species

Female. Length, about 14.5 mm., anterior wing, 10.2 mm.; robust, black, with black (very dark chocolate) hair all over body and legs, except that there is a small inconspicuous patch of white hair on each side of face, close to eyes; eyes brown; facial quadrangle broader than long; clypeus rugulose, with scattered punctures, and a very strong median keel, not reaching lower margin; mandibles with an orange mark near apex; ocelli in a line; mesothorax shining on disc posteriorly; tegulae piceous; wings fuliginous, not violaceous; first recurrent nervure meeting second transversocubital; second submarginal cell quadrate, a little broader above than below; abdomen finely punctured, thinly hairy; at each extreme side of ventral segments three to five is a very long tuft of black hair.

Colombia (Baker coll.). Possibly the female of *M. aethiops* Smith, of which only the male is known, but apparently distinct by the uniformily dusky wings. The dark wings also separate it from *M. melaena* Spinola and *M. corvina* Friese. *Tetralonia mephistophelica* Schrottky, known only in the male, is too large, and has the wings with bluish or violet reflections. There is a close general resemblance to the North American *M. caliginosa*

Cresson; superficially the two insects are almost exactly alike, except for the light red hair on hind tibiae of *caliginosa*. The venation is different, however, and the second and third abdominal segments of *atramentata* are finely punctured all over, which is not true of *caliginosa*. The eyes of *atramentata* distinctly converge above, but this is not true of *caliginosa*. *M. atramentata* also differs by the pointed hind knee-plate, and less copious scope of hind legs. I have not attempted to extract the mouth-parts of the unique type of *M. atramentata*, so its reference to *Melissodes* is provisional.

**Melissodes nigroaenea** (Smith)

Carcaraña, Argentina (Bruner). 64 is a male; 29 a female with black hair at sides of metathorax, 89 a female with this hair all pale. The hair of the mesothorax above is gray, with a transverse black band. Maxillary palpi in both sexes four-jointed, joint four considerably shorter than three. These insects differ appreciably from typical *nigroaenea* described by Smith; they should probably stand as subsp. *tintinnans* (Holmberg).

**Melissodes svastrina** new species

Male. Length, about 11 mm., anterior wing, 9.5 mm., flagellum, 9.2 mm.; black, small joints of tarsi ferruginous; clypeus (except a spot on each side, not marginal) and large spot at base of mandibles lemon yellow; labrum cream-color; mandibles ferruginous in middle, and with an orange band on apical part; maxillary palpi very small, three-jointed, the two last joints very short and stout; paraglossae reaching beyond middle of second joint of labial palpi; first joint of labial palpi about 1280 microns long, second about 770; facial quadrangle about square; malar space linear; scape black, flagellum bright ferruginous beneath and dusky above; third antennal joint very short, broader than long; hair of head and thorax pale ochreous, becoming rich fulvous on vertex and dorsum of thorax, and white on cheeks and under side of thorax, while on scutellum anteriorly it is reddish-fuscous; tegulae ferruginous; wings dusky hyaline, nervures and stigma ferruginous; second submarginal cell large, receiving first recurrent nervure not far from end; legs with mainly pale hair, but stained with sooty on hind tibiae posteriorly; spurs pale ferruginous; abdomen with long ochreous hair on basal part of first segment; second segment with a straight broad entire band of cream-colored tomentum at base; third with a very broad band of the same; fourth with a weak grayish band beyond middle, and before this are long black hairs; fifth like fourth; apical plate very broadly truncate; the abdomen seems to have a very faint metallic tint.

Carcaraña, Argentina (Bruner 31). On account of the three-jointed palpi this is related to *M. melochiae* and *M. minarum* of

Bertoni and Schrottky, but it is much larger. The ornamentation of the abdomen is like that of the genus *Florilegus*. The general appearance of the insect is exactly like *Svastra bombylans* Holmberg, but it is easily distinguished by the dark scape and other characters.

**Melissoptila pulchricornis** new species

Male. Length, about 8 mm., antennae reaching to end of first abdominal segment; black with the knees, tibiae at apex, and all the tarsi ferruginous; clypeus strongly punctured, the lower part pallid or wholly black, labrum pallid or black; mandibles with a large yellow basal patch, beyond which is a red patch; maxillary palpi two-jointed, the joints subequal in length, the second broad, but with slender pale base; flagellum bright ferruginous beneath, except the last three joints and apex of the one before, which are black; eyes green; hair of head and thorax dull white, strongly stained with fuscous on scutellum and hind part of mesothorax; mesothorax shining, with scattered punctures; tegulae dark fuscous; wings dusky, nervures rufo-fuscous; second submarginal cell very broad; basal nervure falling short of transversomedian; legs with white hair, ferruginous on inner side of tarsi; abdomen with very broad bands of appressed yellow hair on segments two to five, and a narrow one on first; apical plate very broad.

Carcaraña, Argentina (Bruner 52). The condition with pallid labrum and margin of clypeus may be due to immaturity. One specimen is pinned on the same pin as a *Diadasia callura*. The insects are very much alike in general appearance, and were evidently taken for sexes of one species. *M. pulchricornis* differs from *M. bonaerensis* Holmberg by the wholly or mainly dark clypeus. By the color of the flagellum it recalls the much larger *M. richardiae* Bertoni and Schrottky.

**Xenoglossodes lusor** new species

Male. Length, about 10.5 mm., anterior wing, 7.5 mm.; black, robust, covered with long ochraceous hair, fulvous on thorax and abdomen above, that on abdomen erect, except on narrow margins of second and following segments; eyes brown; facial quadrangle broader than long; clypeus, labrum and base of mandibles bright lemon yellow; maxillary palpi five-jointed, second thick but cylindrical, third long, slender, and cylindrical, fourth very long and slender, fifth slender, measurements in microns: (3.) 176, (4.) 130, (5.) 80; scape black; flagellum very long, bright orange-ferruginous, dusky above; third antennal joint about as long as apical width; mesothorax shining, the disk almost impunctate; tegulae dark fuscous; wings hyaline, faintly dusky, nervures fuscous, only two submarginal cells, the second transversocubital nervure missing; tarsi elongated, ferruginous; legs with fulvous hair; venter of abdomen with deep red hair-bands.

Carcarañia, Argentina (Bruner 36). In general appearance resembles *Tetralonia gilva*, *Leptometria pereyrae*, etc., but easily distinguished by the palpi and other characters, including the apparently normal two submarginal cells.

**Xenoglossodes manca** new species

Male. Length, about 10 mm., anterior wing, 7 mm., flagellum very long, 7.3 mm.; black, covered with pale ochraceous hair, much shorter on abdomen than in *X. lusor*; eyes brown; facial quadrangle about square; clypeus, labrum and base of mandibles creamy white; apical part of mandibles with an orange patch; maxillary palpi five-jointed, second joint very long and stout, third long, slender and cylindrical, fourth very short, fifth longer than fourth, measurements in microns: (3.) 145, (4.) 40, (5.) 65; scape black; flagellum very slender, bright fulvoferruginous beneath, dusky above; fourth antennal joint hardly longer than third; mesothorax highly polished, sparsely punctured; tegulae rufotestaceous; wings hyaline, nervures ferruginous; three submarginal cells, but first transversocubital represented only by a stump on one side; knees, tibiae at apex, and tarsi more or less ferruginous; legs with ochreous hair; hind margins of abdominal segments hyaline, but covered with fine hair; apex rufous.

Carcarañia, Argentina (Bruner 55). Resembles the last, but quite distinct.

**Xenoglossodes mimetica** (Brethes)

Female. Length, about 11 mm., anterior wing, 9 mm.; robust, black, covered with reddish-fulvous tomentum, paler on face and under side of thorax; labrum black, with white hair; mandibles with a broad orange stripe on apical half, and with a small inner tooth remote from the blunt apex; clypeus black, densely and coarsely rugosopunctate; flagellar joints obscurely reddish apically; mesothorax shining and strongly punctured; tegulae rufotestaceous; wings slightly dusky, nervures fuscous; small joints of tarsi ferruginous; abdomen densely covered with bright fulvous tomentum, suffusedly redder on apical margins of segments; first ventral segment emarginate. The joints of maxillary palpi measure in microns, (2.) 176, (3.) 160, (4.) 95, (5.) 40.

Like *Leptometria*, with the same venation (see especially short broad marginal cell and venation of hind wings), but maxillary palpi five-jointed, first joint stout, second slender, third broader, broadening apically, fourth very stout, fifth minute, fourth and fifth bristly at end, no lateral hair-fringes. Omitting the last joint, the palpi may be said to be clavate.

Carcarañia, Argentina (Bruner 62). This was described as a *Svastra*, but it is probably nearer to *Leptometria*, notwithstanding the character of the palpi. It may well go in the North American genus *Xenoglossodes*.

**Svastra leucostoma** new species

Male. Very close to *S. bombylans* Holmberg, differing as follows: fulvous hair of head and thorax not quite so red; hair at base of abdomen dull whitish, not covering so much of first segment; a white hair-band at base of second segment, but third and following segments entirely black; clypeus, labrum and base of mandibles pale cream-color (lemon yellow in *bombylans*), the yellowish color of clypeus with a rectangular incision on each side; scape in front entirely black (yellow in *bombylans*); third antennal joint much shorter; flagellum shorter, deep ferruginous beneath; nervures fuscous throughout; second submarginal cell broader; hair of hind femora and middle tibiae black in front, of hind tibiae black except a white streak at base behind, of middle and hind tarsi black. The maxillary palpi are five-jointed, joints one and two large and subequal in length, three much smaller, four and five minute.

Carcaraña, Argentina (Bruner 12). *Tetralonia flavitarsis* Spinola has much longer antennæ.

**Svastra sapucacensis** new species

Female. Length, about 15 mm., anterior wing, 10.7 mm.; very robust, black, including clypeus, labrum, tegulae and legs; mandibles very broad, simple, with a large orange patch on apical part; malar space linear; blade of maxilla not much attenuated; paraglossae long and slender, fully as long as labial palpi; maxillary palpi five-jointed, the last joint long, looking like two coalesced, first three joints large and thick, the others narrow, measurements of joints in microns (3.) 176, (4.) 80, (5.) about 160; labrum covered with chocolate-colored hair; clypeus very strongly and densely punctured, with no median ridge or line; facial quadrangle about square; antennal joints five to ten bright ferruginous beneath, eleven and twelve dusky reddish, but one to four black; hair of face and round antennae white, but black on vertex, occiput and cheeks posteriorly; mesothorax shining, strongly and closely punctured, but scutellum more closely; area of metathorax extremely densely punctured, with an impunctate median band; hair of upper border of prothorax, tubercles, lateral margins of metathorax, a fringe along hind margin of scutellum, tuft behind wings and sides of metathorax, white, but other parts of thorax, such as mesopleura, have black hair; wings dusky translucent; nervures fuscous; second submarginal cell nearly square, receiving first recurrent nervure beyond middle but not near end; third submarginal cell very long; legs mainly with black hair, but in certain lights the stiff hair of outer side of hind tibiae and tarsi is brilliant shining silver, and the same occurs at base of middle tibiae; abdomen broad, the first two segments finely and closely punctured, with little hair, but the second with a fulvous apical band; segment three covered at base and apex with bright fulvous hair; the remaining segments entirely covered with very rich reddish-fulvous tomentum; apical plate pale brown; venter with bright ferruginous hair.

Sapucay, Paraguay, March (W. T. Foster). Not a typical *Svastra*, but it falls better here than elsewhere. The venation disagrees with *Xenoglossa*. There is a close general resemblance to *Xenoglossa apiculata* (Cresson.)

**Svastra carcaranensis** new species

Female. Length, about 12 mm., anterior wing, 9 mm.; robust, coal black, with black hair throughout, except that the fourth abdominal segment has a large pure white patch at each extreme side, and the fifth smaller ones, while the third and fourth ventral segments have a long black fringe, which at extreme sides gives way to pure white. Mandibles with a long bright orange stripe; clypeus rugose and punctate; flagellum bright ferruginous beneath, except at extreme base; facial quadrangle considerably broader than long; posterior disc of mesothorax polished, with only scattered minute feeble punctures; tegulae black; wings dusky hyaline, rather dark; first recurrent nervure meeting second transversocubital; abdomen shining, without distinct punctures; hind femora dark reddish.

Carcaraña, Argentina (L. Bruner 10). This is easily known from *Tetralonia zebra* Friese by the venation, and from *T. corvina* Friese by the color of the antennae.

**Svastra reductior** new species

Female. Like *S. carcaranensis*, but smaller, length, 10.5 mm., anterior wing, 8 mm.; mandibles dark chestnut red in middle, but without any orange stripe; tegulae reddish. Perhaps only a variety of the last, but it looks distinct, and is probably adapted to a different flower. Mr. J. C. Crawford mounted the mouth-parts, and the following measurements are in microns: maxillary palpi, joints (1.) 192, (2) 128, (3.) 128, (4.) 64, (5.) 80; labial palpi, joints (1.) 1150 long and 224 broad near apex, (2.) 608 long. The measurements of the maxillary palpi are not quite exact, as the palpi do not lie in a plane precisely parallel with that of the slide.

Carcaraña, Argentina (L. Bruner).

**Tetralonia gilva** Holmberg

Both sexes from Carcaraña, Argentina (L. Bruner, 14, 54).

**Tetralonia brethesi** Jörgensen

Female. Carcaraña, Argentina (Bruner 41). It differs only from the description in the shorter wings, which are 7.5 mm. long. The labrum has a long tuft of rufous hair at apex. Maxillary palpi slender, six-jointed, no lateral hair-fringes; joints two and three subequal, four and five shorter and subequal (together 250 microns), six much shorter (about 80 microns). Paraglossae as long as labial palpi. Its nearest relative is the following species:

**Tetralonia eophila** new name

*Tetralonia orientalis* Bertoni and Schrottky, Zool. Jahrb., 1910, p. 569 (not *Tetralonia orientalis* Friese, 1896, described under *Eucera*).

**HOLMBERGIAPIS** new name

*Scirtetica* Holmberg, 1903 (not Saussure, 1884). Type *Holmbergiapis antarctica* (*Scirtetica antarctica* Holmberg). Brethes regards this as part of *Tetralonia*, but it is at least a valid subgenus.

**TELEUTEMNESTA** Holmberg

*T. fructifera* Holmberg, the first species, is herewith designated as the type.

**Diadasia callura** new species

Female Length, 8 to 9.5 mm.; black, with the small joints of tarsi ferruginous; head and thorax with white hair, short on thorax above; mandibles with a subobsolete inner tooth; maxillary palpi six-jointed, joints three and four with long lateral hair-fringes, joints quite broad and of about equal width; blade of maxilla neither hairy nor suddenly narrowed apically; paraglossae much shorter than first joint of labial palpi; clypeus shining, strongly punctured, but with a smooth median band; flagellum short and thick, dusky reddish beneath; mesothorax shining, strongly punctured; tegulae black; wings slightly dusky; second submarginal cell narrowed above, receiving first recurrent nervure beyond middle; basal nervure meeting transverso-median; outer side of tibiae and tarsi with pale yellowish hair, the scape of hind legs entirely pale, on inner side of basitarsi ferruginous; hind spur very long, pale testaceous, not hooked at end; first abdominal segment with white hair, the apical margin broadly pallid; segments two to four very broadly covered apically with felt-like bright ochreous hair, its limits not sharply defined, the bases of segments appearing dark, but with short erect hair; apex covered with fulvous hair, no dark patch.

Carcaraña, Argentina (Bruner 53, 51). In Friese's table of Argentine species this runs to *nigriceps* Friese = *distincta* Holmberg, but it is quite distinct from this, and from other species more recently described, especially by the white hair of thorax. The feet have well-developed pulvilli, and the hind wings have the *Diadasia* venation.

The following key will facilitate the separation of the above Anthophoridae. They are from Carcaraña unless the contrary is stated.

Black species, without conspicuous pale hair, or it is confined to very limited areas . . . . . 1

Species not appearing prevailingly black, the light or reddish hair conspicuous . . . . . 5

1. Male; clypeus dark. (Mexico) . . . . . **Melissodes albocollaris** Cockerell
Females . . . . . 2

2. Abdomen without white hair-marks on apical part. (Colombia)
**Melissodes atramentata** Cockerell
Abdomen with white hair-marks or band on apical part . . . . . 3
3. Wings very dark; abdomen with an interrupted white band on fourth segment. (Mexico) . . . . . **Melissodes bimaculata morrilli** Cockerell
Wings not so dark; abdomen with only lateral quadrate white patches . . . 4
4. Larger, mandibles with bright orange stripe.
**Svastra carcaranensis** Cockerell
Smaller, mandibles without orange stripe.
**Svastra reductior** Cockerell
5. Females . . . . . 6
Males . . . . . 14
6. Clypeus marked with yellow . . . . . **Tetralonia gilva** Holmberg
Clypeus without yellow marking . . . . . 7
7. Hair of thorax above bright fulvous . . . . . 8
Hair of thorax above pale gray or white; species smaller . . . . . 9
Hair of thorax above with at least some black or fuscous . . . . . 10
8. Abdomen with three golden bands.
**Thygater bifasciata buccosa** (Vachal)
Abdomen covered with fulvous hair. **Xenoglossodes mimetica** (Brethes)
9. Second abdominal segment uniformly covered with pale hair. (Mexico)
**Dasiapis tropicalis** Cockerell
Second abdominal segment appearing dark basally.
**Diadasia callura** Cockerell
10. Second abdominal segment uniformly covered with pale fulvous hair.
**Tetralonia brethesi** Jörgensen
Second abdominal segment not thus covered . . . . . 11
11. Sides of metathorax with red hair; pleura with black hair.
**Thygater bruneri** Cockerell
Sides of metathorax with hair not red . . . . . 12
12. Fringe on fifth abdominal segment red or fulvous . . . . . 13
Fringe on fifth abdominal segment black.
**Melissodes nigroaenea** (Smith), var.
13. Apical margin of second abdominal segment broadly pallid. (Mexico)
**Xenoglossa rhodophila** Cockerell
Apical margin of second abdominal segment not pallid. (Paraguay)
**Svastra sapucacensis** Cockerell
14. Clypeus wholly or mainly black . . **Melissoptila pulchricornis** Cockerell
Clypeus yellow or cream-color . . . . . 15
15. Flagellum black . . . . . **Tetralonia gilva** Holmberg
Flagellum red beneath . . . . . 16
16. Second abdominal segment covered with fulvous hair . . . . . 17
Second abdominal segment not thus covered . . . . . 18
17. Two submarginal cells; clypeus lemon yellow.
**Xenoglossodes lusor** Cockerell
Three submarginal cells; clypeus creamy white.
**Xenoglossodes manca** Cockerell

18. Hair of abdominal segments three and four black.
**Svastra leucostoma** Cockerell

Some pale hair on segments three and four . . . . . 19

19. Hair of thorax above bright fulvoferruginous.
**Melissodes svastrina** Cockerell

Smaller; hair of thorax above not thus bright.
**Melissodes nigroaenea** (Smith), var.

# COSTA RICAN DIPTERA

## COLLECTED BY PHILIP P. CALVERT, PH.D., 1909-1910

## Paper 3.—A Report on the Ephydridae

BY E. T. CRESSON, JR.

The general introductory remarks relative to this series already have been given, and will be found in the first paper.[1] Included in that introduction is a list of the localities where the material was collected, prepared by Dr. Calvert, consisting of brief descriptions of the topography and the general surrounding conditions of the localities visited.[2] Dr. Calvert collected this material between May 14, 1909 and May 1, 1910.

The present paper treats of the species of the acalyptrate family Ephydridae. The material is especially rich in this group, comprising over one hundred and thirty specimens, representing twenty-eight genera and fifty-seven species. Two new genera and twenty-two new species are introduced and described. The species of this family are most easily collected by sweeping, especially near and over mud or water which may be in stagnant or fresh pools, in running brooks or at the shores of creeks, rivers or oceans. Rarely are they found in pasture or dry woods. It is the endeavor of the writer, in this paper, to present a preliminary synopsis of, or a guide to, the species of this group of Diptera that may be found in Costa Rica. The work is by no means exhaustive in its treatment of the ephydrid fauna, for it will take much more thorough collecting than Dr. Calvert was able to do, to give us anywhere near the number of species which occur in that region so rich in its insect fauna. The types of the new species are in the collection of the Academy of Natural Sciences of Philadelphia.

The engagement of the author in a revisionary study of the Ephydridae of North and South America, makes it possible for him to offer this paper in its present form. Prior to this writing

[1] Trans. Am. Ent. Soc., xl, p. 1, 1914.

[2] A full account of Dr. Calvert's sojourn in Costa Rica is published by The Macmillan Company, New York, "A Year of Costa Rican Natural History" by A. S. & P. P. Calvert, and full notes on his collecting may be found therein.

there has been practically no work done on the Central American species, instead only isolated descriptions of new forms. Consequently the literature gives very little trouble. Furthermore, the writer has examined the types of most of the known species occurring, or likely to occur, in Costa Rica. In view of the forthcoming revision of the American Ephydridae, of which two papers have already appeared,[3] the species in the present paper are not as fully treated as they otherwise would have been. However, the descriptions of the new forms are full enough to enable the student to recognize them, and pertinent notes are given on most of the others, while analytical tables, where possible, are given of all the forms treated.

This family, as with the majority of the Acalyptratae, includes species most of which are so small, that a microscope is necessary for their thorough study. In consequence it will not be a very inviting study to many; although the field offers more opportunities for real constructive work than many other groups possessing larger individuals. The writer makes constant use of a Zeiss binocular microscope, with a combination giving a magnification of about forty-five diameters, with an occasional use of a higher power.

As to the systematic limits of the family, little can be said, for much exhaustive study will be necessary before the families of the Acalyptratae can be thoroughly understood. However, the species of this family, as here understood, may be recognized by the structure of the head, especially of the face. There are no vibrissae or vibrissal angle or ridge; the parafacials (the areas next to the eyes), parafacial ridges and groves are never converging below, but always extending posteriorly and ending at the lateral oral margin; the mesofacial area is always convex, sometimes greatly swollen, at most with only a weak carina, except between the antennal foveae in some species. There is usually a series of bristles on each side of the face, which below are concentric with the orbits, while above they may continue so, or, may converge, crossing the face and become contiguous. In the latter case the mesofacial area is prominent and setulose (characteristic of the subfamily Ephydrinae). The auxiliary vein

[3] Trans. Amer. Ent. Soc., xlii, 101–124, 1916 (*Paralimna*). Trans. Amer. Ent. Soc., xliii, 27–66, 1917 (*Notiphila* and *Dichaeta*).

normally coalesces with the first near its extremity, and the discal and second basal cells are rarely separated.

The species seem to merge nicely with some Drosophilids, but the latter have a more or less distinct vibrissae. On the other hand some seem to simulate the Borboridae, but the short basal joint of the hind tarsi will distinguish the members of that family. In the Geomyzidae there is a distinct vibrissal angle and bristle. With the exception of a few genera, for instance—*Brachydeutera*, *Ochthera*, *Psilephydra*, *Canace* and *Planinasus*, the species are very constant, with the above family characteristics well emphasized. The genus *Planinasus* is probably marginal in its position, possibly a representative of another family.

*Analytical Table of the Genera occurring or likely to occur in Costa Rica*

1. Discal and second basal cells separated by a cross vein; cheeks with one or more upcurved bristles. (Maritime species. Neotropical ?)...**Canace**
   Discal and second basal cells not separated; cheeks with or without a ventro-proclinate bristle....2
2. Fore femora greatly dilated; third and fourth veins converging..**Ochthera**
   Fore femora not thickened; third and fourth veins parallel or diverging...3
3. Face below broad, prominent, setulose; mouth large, vaulted; frontal bristles curving laterally over eyes....4
   Face broad, prominent, convex and swollen, not setulose, with no distinct bristles or orbital area; mouth rather narrow; no distinct frontal bristles; antennae small with very long, nearly bare arista....**Psilephydra**
   Face not setulose medianly, with only a series of one or more bristles on each side....6
4. Costa extending to fourth vein....5
   Costa not reaching fourth vein....**Scatophila**
5. Claws generally long, nearly straight; pulvilli minute....**Ephydra**
   Claws small, curved; pulvilli well developed....**Scatella**
6. Middle tibiae with two or more erect extensor bristles....7
   Without such bristles....8
7. Costa extending to fourth vein....**Paralimna**
   Costa not attaining fourth vein....**Notiphila**
8. One or more distinct dorso-central bristles (exclusive of the presutellar pair)....9
   No dorso-central bristles....12
9. Eyes pilose; facial bristles hair-like....10
   Eyes bare; facial bristles strong....11
10. Frontal bristles absent; face prominent below....**Nostima**
    Frontal bristles present; face not produced....**Hydrellia**

11. Face opaque, with nose-like tubercle between antennal foveae; wings spotted ..... **Ilythea**
    Face shining, evenly convex, without nose-like tubercle; wings not spotted, hyaline ..... **Typopsilopa**
12. Face very short; mouth large, with margin anteriorly attaining the nose-like tubercle between the foveae; opaque brown species with contrasting, silvery pleura ..... **Brachydeutera**
    Face large, prominent below, without tuberculous swelling; epistoma scarcely retreating ..... **Napaea**
    Face evenly convex or more or less tuberculate; epistoma generally retreating ..... 13
13. Abdomen broad, circular in outline; face with a median, prominent, semiglobose swelling; black, shining species ..... **Gastrops**
    Abdomen ovate ..... 14
14. First three abdominal segments together not longer than fourth, with flattened depressed area on dorsum ..... **Lytogaster**
    Abdomen normal ..... 15
15. All head and thoracic bristles reduced to setulae, or wanting; antennae retained in pit-like foveae. (Neotropical?) ..... **Mosillus**
    At least vertical and scutellar bristles well developed ..... 16
16. Third antennal joint elongate, decumbent; spine weak or wanting. (South America and West Indies) ..... **Ceropsilopa**[4]
    Third joint short, or, if elongate, spine well developed ..... 17
17. Facial bristles strong; third antennal joint lenticular ..... 20
    Facial bristles strong; third antennal joint elongate ..... 18
    Facial bristles hair-like; third joint short ..... 22
18. Face with two pairs of bristles. (South America.) ..... **? Clasiopella**
    With only one pair ..... 19
19. Frons and face oblique, in same plane; face most prominent at epistoma. **Plagiops**
    Frons and face convex in profile; epistoma retreating ..... **Psilopa**
20. Mesonotal setulae in distinct series ..... 21
    Setulae scattered, not seriated ..... **Discocerina**
21. Third costal section at least equal in length to second; wings noticeably pointed at tip of third vein ..... **Atissiella**
    Third costal section at most one-half as long as second; wings not pointed. **Allotrichoma**
22. Face evenly sculptured in distinct transverse furrows. (South America.) **Cerometopon** Cresson[5]
    Face at most minutely pitted on the facalia ..... **Ochtheroidea**

[4] *Ceropsilopa* Cresson. Described in Ent. News, xxviii, 340, 1917.
[5] Ent. News, xxv, 241, 1914.

## NOTIPHILA

1823. Fallen, Dipt. Suec. Hydromyz., 7.

Here we have a genus not easily confused with any other. The costa extends to, or only slightly beyond, the tip of the third vein, never attaining the fourth. The middle tibiae have three or four erect bristles on their extensor surfaces. The face is flat or gently convex, at most but slightly prominent in profile. The middle femora of some males are noticeably ciliate beneath.

Three species are recognized from Costa Rica.

*Table of Known Central American Species*

1. Middle tibiae with three extensor bristles; facial bristles confined to lower half. (*Notiphila*) ..... 2
   Middle tibiae with four extensors; facial bristles in series extending to foveal region; frons and mesonotum distinctly striped. (*Agrolimna*) .. **frontalis**
2. Mesonotum distinctly striped, at least with a broad lateral stripe ..... 4
   Mesonotum not so striped ..... 3
3. Abdomen with two series of large, triangular spots, which attain apices and lateral margins of segments. (Cuba) ..... **fulvimana**
   Abdomen with two or four series of small spots ..... **erythrocera**
4. Face with a median brown stripe. (Panama) ..... **facialis**
   Face immaculate ..... **virgata**

**Notiphila erythrocera** Loew Pl. III, fig. 1, 2.

1878. *Notiphila erythrocera* Loew, Zeit. f. Ges. Naturw., li, 194.

This seems to be the representative species of the northern neotropical countries. It may be best recognized by the broad face, pale second antennal joint, broad face with one to three well developed bristles each side and the immaculate, or at most faintly vittate, mesonotum. The general color is ochreous; even the browns and the dark areas are overcast with this color. The females should not be confused with those of *virgata*, which have the browns of the abdomen more or less shining and the mesonotum distinctly vittate.

The species was described from Cuba. It is represented by fifty-eight specimens, collected by sweeping over mud at the following localities: Alajuela, September 15; Bonnefil Farm, Rio Surubres, October 21; Cartago, December 12 to May 17; Laguna, near Cartago, February 26; El Alto, July 7; Filadelfia, Rio Tempisque, January 18; Guacimo, May 6; Juan Viñas, July 30; Peralta, August 7 and March 24; Turrucares, December 22.

**Notiphila virgata** Coquillett

1900. *Notiphila virgata* Coquillett, Proc. U. S. Nat. Mus., xxii, 259.

This species, in the male, has the middle tibiae distinctly ciliate with comb-like series of short bristles. The antennae are mostly pale, the mesonotum distinctly vittate, and the abdomen with four series of brown spots. It is very distinct from *erythrocera*, and in general easy to distinguish, although the vittate individuals of that species are often confusing. The females may, on the other hand, be confused with the recessive forms of *facialis*.

Originally described from Porto Rico. Twenty-five specimens were collected, mostly over mud, from the following localities: Alajuela, September 8; Cachi, near Rio Reventazon, March 4; Cartago, February 19 to May 17; Juan Viñas, February 14; Peralta, March 24.

**Notiphila frontalis** Coquillett

1904. *Notiphila frontalis* Coquillett, Proc. Ent. Soc. Wash., vi, 97.

In this species the frons especially, and the mesonotum, are distinctly vittate. The frontal stripes are velvety black, the orbits and face being golden yellow. The broad abdominal bands attain the apices of the segments medianly. This is a pretty and well marked species, probably a neotropical representative of the northern *pulchrifrons* Loew.

Originally described from Nicaragua, and represented in our material by eleven specimens: Banana River, November 9; Cartago, February 19 to May 17; Turrucares, December 22.

## PARALIMNA

1862. Loew, Mon. Dipt. N. Am., i, 138.

This genus is well represented in Costa Rica. The species, however, are difficult to determine, and my recent revision of this genus should be consulted by the student who desires to become more acquainted with the species. In this paper I will give only a table of the species known to occur in Costa Rica, with a list of the material examined and some pertinent notes. The genus is characterized by the presence of three extensor bristles on the middle tibiae and the continuation of the costa to the fourth vein.

*Table of Costa Rican Species*

1. Pleura and venter more or less cinereous, contrasting with the dorsum; face large, swollen and prominent ..... 2
   The entire thorax and venter, dark, unicolorous; face less prominent.
   Opaque species ..... **decipiens**
   Shining species ..... **obscura**
2. Second antennal joint with a flattened, mostly silvery, area above at apex .. 3
   Second joint normal, without such area ..... 4
3. Frons horizontal; face dark ..... **puncticornis**
   Frons convex; face white ..... **argyrostoma**
4. Fore femora of males more or less constricted beneath on apical third, and with a mesal series of curved, flattened bristles; females with face sericeous, light in color ..... **ciliata**
   Fore femora normal; face gray to brown ..... 5
5. Face, except foveae and parafacials, entirely dark brown .... **brunneiceps**
   Face mostly cinereous or yellowish brown ..... **meridionalis**

**Paralimna (Phaiosterna) decipiens** Loew

1878. *Paralimna decipiens* Loew, Zeit. f. Ges. Naturf., 1878, 195, [Texas].
1916. *Phaiosterna decipiens* Cresson, Tr. Amer. Ent. Soc., xlii, 108.

This and the following form constitute a group, which I have given the subgeneric name of *Phaiosterna*. They are separated from the other species by the absence of any decided gray or white dusting. The abdominal segments may have olivaceous tinged bands, but no other parts are so marked, at least not with gray or white.

In this species the variation in the amount of opacity or pruinosity, and in the color of the same, ranges from dark brown to golden brown. The light abdominal bands are sometimes so broad that they occupy the entire segment. Abraded specimens may have the thorax shining, so that there is some danger in confusing these with the next species, therefore care should be used in determining such material.

The species is well distributed in Neotropical North America.

Sixteen specimens were collected from the following localities: Muddy bank of Rio Tempisque, Filadelfia, January 18; Santa Cruz, Rio de la Cañas, January 30; Along ditch in Cartago, May 25 and July 4.

**Paralimna (Phaiosterna) obscura** Williston

1896. *Paralimna obscura* Williston, Tr. Ent. Soc. London, 1896, 391, [St. Vincent].
1916. *Phaiosterna obscura* Cresson, Tr. Ent. Am. Ent. Soc., xlii, 109.

This is not considered a very well defined species. The typical specimens, however, are easily determined by the total absence of pollinose surfaces, except perhaps on the face and pleura. There may be faint dustings of pollen but never so as to obscure the shining surfaces.

This form is known to range south to Paraguay. Three specimens were collected in Costa Rica at the following localities: Muddy bank of Rio Tempisque, Filadelfia, January 18; Santa Cruz, Rio de la Cañas, January 30.

**Paralimna ciliata** Cresson Pl. III, fig. 4.

1916. *Paralimna ciliata* Cresson, Tr. Am. Ent. Soc., lxii, 111.

A species belonging to a group in which the males have the fore femora distinctly ciliate beneath with flattened, curved hairs. The females are difficult to separate from those of *meridionalis*, but the face here is sericeous, light gray or yellowish to nearly white.

Described from Costa Rica and is represented by twelve specimens: Near upper reservoir, Banana River, November 9; Over mud, Cartago, October 27 to January 3; Over mud on southern slope of Irazú, north of Cartago, December 15.

**Paralimna meridionalis** Cresson Pl. III, fig. 3.

1916. *Paralimna meridionalis* Cresson, Tr. Am. Ent. Soc., xlii, 119.

This species seems to represent *appendiculata* in the Neotropical Region. It ranges from Guatemala to Argentina, while *appendiculata* ranges northward. It is possible that *appendiculata* will be found in Costa Rica. The present species is the one likely to be most abundant in the neotropics and is distinguished by the general dark color; the face is dull gray, not sericeous, with the usual three dark dashes of brown or yellow. The legs are not furnished with any peculiar bristles, but the fore femora are ciliate with closely set bristles.

Originally described from Costa Rica and represented by thirty specimens: Alajuela, September 15; Upper Reservoir, Banana River, November 9; Stagnant pool on bank of Rio Reventazon, Cachi, March 10; Cartago, July 4 to December 12; Irazú Volcano, December 15; La Carpentera, December 4; Bonnefil Farm, Rio Surubres, October 21; Turrucares, December 21.

**Paralimna brunneiceps** Cresson

1916. *Paralimna brunneiceps* Cresson, Tr. Am. Ent. Soc., xlii, 120.

A species in general similar to *meridionalis*, but the face, with the exception of the orbits and foveae, is evenly dark brown. It may prove to be only a variety of that species.

Originally described from Costa Rica and represented by ten specimens: Alajuela, September 8 to 15; Rio Siquiares, December 19; Turrucares, December 22; Bonnefil Farm, Rio Surubres, October 21.

**Paralimna argyrostoma** Cresson

1916. *Paralimna argyrostoma* Cresson, Tr. Am. Ent. Soc., xlii, 120.

This well marked species, known only from Costa Rica, has the face silvery white and the general body color olivaceous, not brown, and a silvery spot on the upper apical angle of the second antennal joint. This should not be confused with the next species.

Eight specimens collected: Near upper reservoir, Banana River, November 9; Rio Aranjuez, Puntarenas, September 15, 1905, (F. Knab), [U. S. N. M.].

**Paralimna puncticornis** Cresson

1916. *Paralimna puncticornis* Cresson, Tr. Am. Ent. Soc., xlii, 121.

This species also has the silvery spot on the second antennal joint, but is darker than the preceding, more brownish, not greenish, and the face is dark, hardly grayish. It has the frons rather horizontal, but the eyes are round and large.

It is known to range south to Colombia. Only one specimen seen from Costa Rica: Peralta, March 24.

## HYDRELLIA

1830. Desvoidy, Myod., 730.

A genus closely resembling *Notiphila* in general characters, but the species are much smaller, with pilose eyes; the costa extends to fourth vein, and the middle tibiae are not possessed of the characteristic extensor bristles.

The species known from Costa Rica may be separated as follows:

Palpi black.

Only one dorso-central, excluding prescutellar pair; frontal stripes velvety black; face densely silvery-white..... **tibialis**

Two such bristles; face dull ochreous to black ..... **calverti**

Palpi yellow.
Second antennal joint of male with distinct spine; fore femora of female with series of blunt spines on inner flexor margin.....**spinicornis**
Without such characters.....**hypoleuca**

**Hydrellia tibialis** Cresson
1917. *Hydrellia tibialis* Cresson, Ent. News, xxviii, 341.

This species is easily distinguished by the characters given in the table of species. The Costa Rican specimens seem to be identical with the type, although perhaps slightly more shining and somewhat smaller.

Represented by two specimens, collected over mud in Cartago, December 12.

**Hydrellia calverti** new species

Black; extreme bases of tarsi pale; halteres lemon yellow. Wings hyaline. Shining, metallic green. Frontal stripes opaque, black. Lunule and face opaque, sericeous, ochreous to black. Pleura grayish. Femora brownish. All tibiae silvery on outside.

Face roundly carinated above, slightly swollen below; twice as long as broad, with two to four bristles on each side. Mesonotal bristles strong; dorso-centrals 1: 1. Middle tibiae not enlarged. Second costal section slightly longer than third. Length.—1.5 mm.

*Type*.—♂; Bonnefil Farm, Rio Surubres, Costa Rica, October 20, 1909, (sweeping at 800 ft. alt.), [Type No. 6120].

**Hydrellia spinicornis** new species Pl. III, fig. 5.

In general respects similar to *hypoleuca* Lw.

Black; palpi, joints of femora and tibiae and bases of tarsi, pale. Halteres yellowish white. Wings subhyaline, brownish with black veins. Opaque; mesonotum, scutellum and abdomen somewhat shining. Dorsal surfaces brownish pollinose. Face and lunule white; occiput below, pleura, venter, femora, and tibiae light gray.

Face flat or slightly convex below, with five to seven bristles on each side. Antennae of male with second joint distinctly produced at angle and furnished with distinct spine. Dorso-centrals arranged 0: 1, near suture. Fore femora of female with series of minute, blunt spines on apical portion of inner flexor margin. Length.—2.25 mm.

*Type*.—♂; Alajuela, Costa Rica, September 15, 1909, (sweepings at 3100 ft. alt.), [Type No. 6121]. *Paratypes*.—1 ♂, 1 ♀; topotypical.

Another female, along ditch at Cartago, May 17, also belongs here.

**Hydrellia hypoleuca** Loew

1862. *Hydrellia hypoleuca* Loew, Mon. Dipt. N. Am., i, 151.
1862. *Hydrellia scapularis* Loew, Mon. Dipt. N. Am., i, 152.

I cannot separate the Costa Rican specimens specifically from those found in the United States. The species is very variable, and probably is a variety of the European *griseola*. The color of the face ranges from white to yellow or golden, and perhaps specimens will be found with it nearly black, as in variety *obscuriceps* Loew.

The above synonymy is suggested and is probably correct. The form with yellow face has been described as *scapularis*.

The species is represented by seven specimens: Over mud at Cartago, May 17, July 4, and November 21; Laguna del Dirumbo, southern slope of Irazú, July 13.

## NOSTIMA

1900. Coquillett, Can. Ent., xxxii, 35.

Closely allied to *Philygria*, if not congeneric. The only constant character I can find is the presence of but two pair of dorsocentrals, and generally the arista has long hairs above.

Two species are known from Costa Rica, and may be separated as follows:

Wings hyaline; legs entirely pale..... **immaculata**
Wings blackish, marked with numerous rounded white spots; legs spotted. **slossonae**

**Nostima slossonae** Coquillett Pl. III, fig. 15.

1900. *Nostima slossonae* Coquillett, Can. Ent., xxxii, 35, (Florida).
1914 *Philygria calverti* Cresson, Ent. News, xxv, 274, pl. x, f. 2, (Costa Rica).

This is the prettiest species of the genus, and cannot be mistaken when once seen. The conspicuously marked wings and the gray spotted mesonotum and abdomen are very characteristic.

Represented by two specimens: Alajuela, September 15, and Juan Viñas, April 28 (at brook near woods).

**Nostima immaculata** new species

This species may be easily distinguished by the opaque, immaculate frons and mesonotum, shining abdomen and immaculate wings.

Black, face medianly, antennae except upper margin of third, palpi, halteres and legs, yellow.

Opaque; abdomen, especially segments four to six polished. Frons and mesonotum brown. Face and cheeks yellow or grayish; occiput and pleura cinereous; facial orbits, apical margin of third and apical spot on fifth abdominal segment, silvery.

Face vertical, lower part convex, scarcely prominent. Cheeks broad as third antennal joint. Arista with eight long hairs above. Abdominal segments four and five subequal in length. Wings hyaline, immaculate with costal sections two and three subequal; penultimate section of vein four twice as long as posterior cross vein. Length.—1.25 mm.

*Type.*—♂; Bonnefil Farm, Rio Surubres, Costa Rica, October 20, 1909, (sweeping, 800 ft. alt.), [A. N. S. P. No. 6122].

A topotypical female in poor condition shows three apical silvery spots on segment four and one or three on five. There may be similar spots on two and three.

## ILYTHEA

1839. Haliday, An. Nat. Hist., iii, 408.

This genus is well characterized by the broad face with its nose-like carina, and the spotted, thick veined wings. The species should not be confused with those of *Scatella* with similarly marked wings. The genus is well represented in Costa Rica, and the known species may be separated as follows:

1. Second costal section more than three times as long as third; veins two and three parallel; femora black ..... **caniceps**
   Second costal section not twice as long as third; veins two and three markedly divergent; femora mostly pale ..... 2
2. Wings with four brown spots in first posterior cell, excluding costal cloud. **calverti**
   First posterior cell with only three spots ..... 3
3. Wings with two brown spots between apices of veins two and three. **fenestralis**
   Wing with but one spot between these veins.
   Abdomen shining, jet black ..... **flavipes**
   Abdomen subopaque, brownish ..... **obscura**

**Ilythea caniceps** new species

Similar in structural and most color characters to *spilota* Curtis, which I have seen from North America. It differs, however, in the frons being shorter and broader in proportion; face narrower and longer and white or nearly silvery, wholly or nearly so, at least the orbits always silvery. This color is seen when viewed from above, the upper face and tubercle remaining brownish. The mesonotum and scutellum are more metallic; the abdomen shining with

rather faint bluish tinge; knees, tibiae, and tarsi, except apices, pale. Length.—2 to 2.3 mm.

*Type.*—♂; Cartago, Costa Rica, May 25, 1909, (along ditch), [Type No. 6175]. *Paratypes.*—1 ♂, 2 ♀, topotypical.

Also represented by seven specimens collected May 17, over ditches in Cartago and June 15, over mud on the southern slope of Irazú near the road to the crater.

**Ilythea calverti** new species

A species distinguished by the short second vein and the large roundish hyaline spots in the wing.

Black; antennae except bases and apices, mouth parts, legs including coxae, and halteres, yellowish. Shining, more or less metallic tinged, especially the mesonotum and frons. Wings infuscated with large, round, white or hyaline spots between the veins. Face sparingly yellowish, sericeous; polished above the hump. Thorax and abdomen sparingly golden. Second and third costal sections subequal. Marginal cell with two, submarginal with one, and first posterior cell with four, isolated brown spots. Length.—1.5 mm.

*Type.*—♀; Filadelfia, Costa Rica, January 18, 1910, (muddy beach of Rio Tempisque), [Type No. 6123].

Another female from Juan Viñas, April 28, collected at a brook near woods.

**Ilythea fenestralis** new species Pl. III, fig. 21.

Similar to *calverti*, but the hyaline areas are much broader and more quadrate than the infuscated interspaces, and arranged more or less to form fasciae across the wings.

Black; antennae, mouth parts, halteres, legs, and sometimes face below, tawny. Shining above, sparingly brown pruinose below. Frons and mesonotum, and scutellum strongly tinged with metallic blue and purple. Face white and brown, sericeous. Cheeks as broad as antennae. Wings with venation and maculation as figured. Length.—1.5 to 2 mm.

*Type.*—♂; Cartago, Costa Rica, May 25, 1909, (along ditch), [Type No. 6124].

Also represented by three specimens: Guacimo, June 6, and over mud at Turrucares, December 22.

**Ilythea flavipes** Williston Pl. III, figs. 19, 20.

1896. *Ilythea flavipes* Williston, Trans. Ent. Soc. London, 1896, 403.

Although I am not absolutely certain that the series before me belongs to this species, there is very good reason to think it will prove to be such. The species, as we understand it, may be readily distinguished by the characters given in the table of species.

The species was originally described from St. Vincent, West Indies. It is here represented by a good series of sixteen specimens, collected on the muddy beach of Rio Tempisque, Filadelfia, January 18.

**Ilythea obscura** new species

Similar to *flavipes* but more opaque; the yellowish dust being denser, and the abdomen subopaque, olivaceous and dusted with brown; not polished and jet black. The wing maculation is the same as in that species.

*Type.*—♂; Filadelfia, Costa Rica, January 18, 1910, (muddy beach of Rio Tempisque), [Type No. 6125]. *Paratypes.*— 2♂, topotypical.

Also a male belonging here, from Banana River, November 9.

## PSILOPA

1823. Fallen, Dipt. Succ., Hydrom., 6.

The species of this genus are mostly shining black, rarely pale in color, destitute of dense pruinose vesture. The face is evenly convex, retreating below, rarely and only weakly foveolate, with only one facial bristle. Antennae with strongly developed spine on second joint, and third usually distinctly longer than broad. Mesonotum with setulae arranged in well defined rows, and no dorsal bristles except the usual prescutellar pair.

The species should not be confused with those of *Ochtheroidea* and other allies near *Discocerina*. They may, however, be somewhat difficult to separate from those of the closer allied genera, as *Clasiopella* and *Typopsilopa*. Of the genus *Psilopa*, as here restricted, there are only two species known from Costa Rica, but no doubt others occur there. These two may be separated as follows:

Fore coxae, middle and hind tibiae, pale, fore femora black; face narrow and transversely wrinkled . . . . . **willistoni**

Fore coxae and all femora and tibiae black; face broad and highly polished. **meridionalis**

**Psilopa meridionalis** new species

Black; antennae except apices of third joint, knees, apices of tibiae and basal joints of tarsi, pale. Wings yellowish or whitish, blackened at extreme base, iridescent, with yellow veins.

Shining, more or less metallic tinged. Face highly polished, evenly convex, with bristles below middle of profile. Mesonotum faintly sculptured. Second and third costal sections subequal. Length.—2.8 to 3 mm.

*Type.*—♂; Cartago, Costa Rica, May 17, 1909, (along ditch), [Type No. 6126]. *Paratypes.*—3 ♂, 1 ♀, topotypical.

Six specimens were also collected from the following localities: Cartago, July 4; Laguna de Ochomogo, El Alto, July 4; Near brook Toyogres, southern slope of Irazú, April 6.

This species is probably the neotropical representative, or a subspecies, of the northern *aeneonigra* Lw.

**Psilopa willistoni** new name

1896. *Psilopa nigrimana* Williston, Tr. Ent. Soc. London, 1896, 393 [nec *Notiphila* (*Ephygrobia*) *nigrimana* v. Ros., 1861].

This species belongs to a group comprising species which have the fore tarsi somewhat dilated and always black; the face is narrow, transversely convex and more or less rugulose, with the bristles situated near the middle of the profile. The present species is recognized by the yellow fore coxae, black femora and immaculate wings.

Two specimens were collected on the muddy beach of Rio Tempisque at Filadelfia, January 18.

The synonymy of *nigrimana* is possible on account of the synonymy of the genera *Psilopa* and *Ephygrobia*. This situation necessitated the creation of a new name for Williston's species.

## TYPOPSILOPA

1916. Cresson, Ent. News, xxvii, 147.

Allied to *Psilopa*, but with two pairs of well developed dorsocentral bristles, exclusive of the usual prescutellar pair.

**Typopsilopa flavitarsis** Cresson Pl. III, fig. 7.

1916. *Typopsilopa flavitarsis* Cresson, Ent. News, xxvii, 147, (Arizona).

Very similar to *Psilopa atra* Loew of the United States which belongs to this genus, but the frons is very much obscured, causing the frontalia to be less distinct; the face is longer, more obscured and wrinkled with the bristles situated higher. All tarsi are yellow. Length.—3 mm.

One specimen: Near pond at Peralta, July 7.

## PLAGIOPS new genus

Belonging to the group *Psilopini* and closely related to *Discomyza*, *Clanoneurum* and *Peltopsilopa*. It is recognized by the oblique head with the smooth, polished face, which is nearly

straight but oblique in profile, and most prominent at the epistoma. The mesonotum is flattened and the scutellum large and rounded in outline. The mesonotal setulae are arranged in well separated rows. In other characters it is similar to *Psilopa*.

Genotype.—*Plagiops nitidifrons* new species.

**Plagiops nitidifrons** new species Pl. III, fig. 12.

Black; antennae, apices of tibiae, and all tarsi, pale. Halteres black. Wings yellow, hyaline with bases as far as middle of costal cell and small cross vein and basal third of anal cell blackened; apex of costal cell clear; veins pale. Shining, with frons, face, and abdomen, highly polished and metallic tinged. Mesonotum with transverse micro-rugose sculpturing; scutellum convex, slightly sculptured, broader than long. Length.—2.2 mm.

*Type*.—♂; Guacimo, Costa Rica, June 6, 1909, [Type No. 6127]. *Paratypes*.—1 ♀ ?, topotypical.

Two more specimens of this species were also collected : Over mud at Peralta, August 7, and at Alajuela, September 15.

**ALLOTRICHOMA** Becker

1896. *Allotrichoma* Becker, Berl. Ent. Zeit., xli, 121.

This genus is allied to *Discocerina*, but the face is subtuberculate, or rather prominent medianly in form of a subconical, but not noticeably shining, tubercle. This character is not so prominent in the known Costa Rican species, but is quite evident. In some species this tubercle is low, causing the lower portion of the face to become protruding, but there is always an evident recession of the epistoma.

Only the following species is known to occur in Costa Rica.

**Allotrichoma abdominalis** Williston Pl. III, fig. 6.

1896. *Hecamede abdominalis* Williston, Trans. Ent. Soc. London, 1896, 398.
1897. *Allotrichoma abdominalis* Williston, Kans. Univ. Quart., vi, 4.

A species distinguished by having the face carinated above the tubercle, and the third and fourth abdominal segments conspicuously silvery-white, which, in well preserved specimens, are in strong contrast with the opaque brown basal segments and the mesonotum. Length.—1.5 mm.

Eight specimens collected at Cartago, February 19, and over mud along the Rio de las Cañas, near Santa Cruz, January 30.

**ATISSIELLA** new genus

Similar to *Atissa*, as based on its type species *Ephydra pygmaea* Haliday, but very distinct in the structure of the face and in the arrangement of the facial bristles.

Face conically prominent, but epistoma retreating; the prominence bearing a pair of stout up curved bristles. There is also a series of two or more down curved bristles below, and a series of dorso-laterally curved hairs along the orbital groove. Wings long, over-reaching the abdomen. Second vein short, so that the third costal section is much longer than the second. Third vein ending in the costa at the pointed apex of the wing.

Genotype: *Atissiella setulosa* new species.

**Atissiella setulosa** new species Pl. III, fig. 9.

Black, more or less brown pruinose, slightly shining except the head. Third antennal joint sometimes yellowish below, basally. Halteres yellow. Basal segment of hind tarsi yellowish. Wings immaculate, obscure hyaline.

Mesonotum with a transverse series of six bristles just behind the sutural region. Fifth abdominal segment of male pointed, triangular. Length.—1 mm.

*Type*.—♂, Cartago, Costa Rica, July 4, 1909, [A. N. S. Type No. 6128]. *Paratypes*.—1 ♂, 1 ♀, Cartago, December 12, 1909, (sweeping over mud); 1 ♂, Juan Viñas, 2600 ft. alt., April 28, 1910, (at brook near woods).

**DISCOCERINA**

1835. Macquart, Hist. Nat., Dipt., ii, 527.
1844. Stenhammar, Hand. K. Sven. Vet. Akad., 251 (*Clasiopa*).

Allied to *Psilopa*. The structure of the face and the form of the third antennal joint are the best characters for separating the two genera. In this genus the former is usually deeply bifoveolated above, in profile prominent medianly, then evenly retreating to the epistoma, with a series of two or more up-curved, more or less converging bristles each side. Antennae short, third joint hardly ever longer than broad, usually not larger than second; spine of second usually minute. However, most of the species may be distinguished by the opaque, pruinose thorax and irregularly arranged acrostichal setulae. In *Psilopa* the species are more shining; facial foveae weak if developed, face not transversely prominent medianly, and the bristles limited to one on each side.

*Table of Costa Rican Species*

1. Face seen from above with stripes or series of silvery or white spots.....2
   Face unicolorous.....5
2. Face shining black with two silvery stripes; frons opaque, metallic colored with orbits and preocellar dash velvety black.....**nana**
   Face with three narrow stripes and orbits silvery; frons evenly shining or brownish.....3
   Facial and frontal orbits silvery; mesofacial area yellowish and separated from orbits by a black stripe.....**pulchra**
3. Opaque species.....4
   Shining black species.....**nitida**
4. Second costal section at least twice as long as third; large species (2.25 mm.). **nepos**
   This section at most slightly longer than third; smaller species (1.7 mm.). **trilineata**
5. Fore femora with short spines beneath; cheeks very broad.....**aenea**
   Femora without spines; cheeks narrow.....6
6. Opaque species with silvery orbits; abdomen velvety black, with apex conspicuously white or silvery; cheeks narrow.....**leucoprocta**
   Not so colored.....7
7. Face with secondary series of minute out-curved bristles; orbits broad and black, silvery.....**setulosa**
   Without secondary series of facial bristles; orbits pale.....**obscurella**

**Discocerina nana** Williston

1896. *Discocerina nana* Williston, Trans. Ent. Soc. London, 1896, 396, (St. Vincent).

This pretty species, belonging to a group in which the orbits are conspicuously silvery, is distinguished by the opaque, velvety black frons contrasted with the two greenish or bluish stripes, and the long narrow face with the median area shining black, margined laterally with the narrow silvery orbits. The general color is shining black, with antennae, halteres and tarsi pale.

One specimen; Juan Viñas, April 28, 1910, (at brook near woods).

**Discocerina pulchra** new species

Black; antennae except apices, palpi, knees, apices of tibiae, and tarsi except apices, pale. Halteres white. Wings hyaline with pale veins.

Frons opaque, brownish with lower orbits silvery. Face opaque, yellowish medianly with shining black, sublateral stripe and broad silvery orbits. Mesonotum subopaque, olivaceous; pleura sparingly grayish. Abdomen shining black. Face with uppermost pair of facial bristles approximate and cruciate, next lower, up-curved mesally, also another series of three to four laterally up-curved bristles. Length.—1.5 mm.

*Type.*—♂; Turrucares, Costa Rica, December 22, 1909, (sweeping over mud), [Type No. 6129].

Another specimen belonging to this species was collected along a ditch in Cartago, May 25.

**Discocerina nitida** new species Pl. III, fig. 8.

Black; antennae except apex above, sometimes facial orbits, knees, apices of tibiae, and all tarsi, pale. Halteres white. Wings hyaline with yellow veins.

Shining; upper surfaces sparingly dusted with brown, lower surfaces polished. Face beneath antennae, narrow orbits, a narrow median stripe, and a sublateral series of occasionally coalescing spots, silvery. Mesonotum with or without greenish tinge. Abdomen black. Length.—1.5 to 2 mm.

*Type.*—♂; Guapiles, Costa Rica, June 4, 1909, (creek in forest south of town, 1100 ft. alt.), [Type No. 6130]. *Paratypes.*— 3 ♂, 3 ♀, topotypical.

The species is also represented by seven specimens, collected at: Filadelfia, January 18, on the muddy bank of Rio Tempisque, and Juan Viñas, April 28, at a brook near woods.

**Discocerina nepos** new species

Similar to *trilineata* but larger, not so densely opaque on mesonotum and frons. The latter above the antennae, and the parafacials more distinctly yellowish; the latter extending above and differentiating the frontalia. Median white facial stripes broader, but orbits very narrowly silvery. Presecutellar bristles strong and supra-alars well developed. Knees and tibiae entirely black. Third costal section nearly three times as long as second. Length.—2.25 mm.

*Type.*—♀; Southern slope of Irazú, near Cartago, Costa Rica, 5000 ft. alt., December 15, 1909, [Type No. 6131].

**Discocerina trilineata** new species

Black; frons at antennae, antennae inferiorly, parafacials, palpi, knees, apices of tibiae, and tarsi except apices, pale. Halteres white. Wings hyaline with yellow veins.

Opaque; abdomen shining, or brownish pruinose on middle of dorsum; femora and tibiae shining. Frons yellowish brown with lower orbits narrowly silvery; face with three conspicuous, longitudinal, median stripes and narrow orbits, densely silvery; occiputal area whitish. Mesonotum and scutellum densely yellowish brown. Length.—1.7 mm.

*Type.*—♂; Juan Viñas, Costa Rica, April 28, 1910, (at brook near wood, 2600 ft. alt.), [Type No. 6132]. *Paratypes.*— 1 ♂, 1 ♀; topotypical.

**Discocerina leucoprocta** subspecies **incisa** Coquillett

1902. *Discocerina incisa* Coquillett, Journ. N. Y. Ent. Soc., x, 182.

Very similar to the typical form. However, the face is narrower, yellowish with broad, conspicuous silvery orbits, the third and fourth abdominal segments with basal angles cinereous and more or less encroaching on the dorsum. The second and third costal sections subequal.

The typical form, *leucoprocta*, may be distinguished from the other species by the opaque, black abdomen, with the ventral lobes and apical segment silvery white in contrast.

This form is represented by eighty-four specimens from the following localities: Alajuela, September 15; ? Banana River, November 9, (at upper reservoir); Bonnefil Farm, Rio Surubres, October 20; Cartago, July 4 to 27; Filadelfia, January 18, (along muddy beach of Rio Tempisque); Guacimo, June 6; Irazú, South slope near Cartago, December 15, (over mud); Peralta, March 24, (over muddy road), Turrucares, December 22, (over mud); Rio Siquiares, December 19; Small stream north of Rio Siquiares, December 20, (over mud); ? Rio Reventazon on Irazú, near Cartago, April 24.

**Discocerina setulosa** new species Pl. III, fig. 16.

Black; third antennal joint, palpi, apices of femora, fore tibiae, extremities of middle and hind tibiae, and all tarsi, pale. Halteres white. Wings hyaline or grayish with costa and veins black.

Opaque or slightly shining above. Frons, mesonotum and scutellum brown or olivaceous, inclining to ochreous; abdomen slightly so in certain aspects. Narrow frontal and broad facial orbits, and cheeks, silvery; upper part of face, occiput, post-alar spots, pleura, venter and femora, grayish to blackish.

A series of out-curved bristles laterad of the usual facial bristles and divergent with them.

*Type*.—♂; Filadelfia, Costa Rica, January 18, 1910, (muddy beach of Rio Tempisque), [Type No. 6133]. *Paratype*.—1 ♀; topotypical.

**Discocerina obscurella** subspecies **parva** Loew

1862. *Discocerina parva* Loew, Mon. N. Am. Dipt., i, 146.

A race distinguished by the black, evenly dusted face, pale orbits, opaque or semi-opaque mesonotum and frons, and a somewhat contrasting black abdomen, which is generally more or less polished apically.

This form seems to be subject to considerable variation, especially in the color of the legs. The tibiae and femora range from entirely black to almost wholly yellow. The latter seem to simulate a variety I have seen from South America.

One hundred and sixty-eight specimens, which I have credited to this form, were found in the material from the following localities: Alajuela, September 15 to February 19; Quebrada de Salas, Altenas Station, May 8; Cartago, October 10 to February 19; Juan Viñas, May 28; Turrucares, December 19 to 22.

**Discocerina aenea** new species

This species is placed here provisionally. Some authors may consider it belonging nearer *Athyroglossa glaphyropus* Lw. It probably represents a distinct genus. In general structure it resembles *Discocerina*, especially those species near *nitida*, but the spinose fore femora suggests species placed in *Athyroglossa* and *Ochtheroidea*.

Black; middle and hind tarsi yellow; fore tarsi black; wings hyaline with pale veins. Shining; mesonotum subopaque, minutely granulose and thinly brown dusted. Small spots laterad of, and below, antennae, and two or three on each facalia silvery. Meso- and sterno-pleura and abdomen highly polished and metallic tinged.

Face broad, evenly convex on lower part of profile, which convexity is not sharply defined from the foveae. Cheeks linear. Mesonotal setulae numerous, in very close series medianly; no pre-scutellar bristles. Femoral spines minute, in series of about twelve. Length.—2.25 mm.

*Type*.— ♀ ; Southern slope of Irazú near Cartago, Costa Rica, December 15, 1909, (sweeping over mud), [Type No. 6137].

## OCHTHEROIDEA

1896. Williston, Trans. Ent. Soc. London, 1896, 401.

A genus, structurally, not sharply defined from *Athyroglossa* Loew. In fact it seems to be its neotropical representative, although one of its species ranges into the nearctic zone. This genus may, however, be easily distinguished by its entirely shining black species, with the fore femora spinose below and the halteres white. At least these characters hold with the known species. The genus is well represented in Costa Rica, that region having five of the seven known species. The other two, being from adjacent countries, are also included in this paper, but will be more fully treated in my Revision.

*Table of Species*

1. All tibiae black; fore tarsi white; cheeks very broad.....**centralis**
   Fore tibiae alone black.....2
2. Wings clouded on disk and at apex.....**fascipennis**
   Wings hyaline or evenly tinged.....3
3. Cheeks at least one-half as high as eyes.....**similis**
   Cheeks at most one-third as high as eyes.....4
4. Mesonotum polished.....**laevis**
   Mesonotum obscurely shining; wings hyaline.....**glaphyropus**
   Mesonotum entirely opaque, granulose; wings tinged with brown; large species.....**atra**

**Ochtheroidea centralis** new species Pl. III, fig. 13, 14.

Black; middle and hind tarsi tawny; fore tarsi, except three apical joints, and halteres, white. Wings hyaline with brown veins. Shining, with mesonotum faintly brown dusted.

Face strongly, subconically convex below. Cheeks one-fourth as high as eyes. Length.—2.5 mm.

*Type.*—♂; Turrucares, Costa Rica, December 20, 1909, (sweeping over mud near small stream north of Rio Siquiares), [Type No. 6136]. *Paratypes.*—2 ♂, 2 ♀; topotypical.

Also represented by a homotypical series of three specimens, from Bonnefil Farm, Rio Surubres, October 20; Alajuela, September 15; Filadelfia, (muddy beach of Rio Tempisque), January 18.

**Ochtheroidea fascipennis** new species

On account of this species occurring in Colombia I include it here, as it is likely to be found within our limits.

Similar to *centralis*, but more slender. Fore tarsi with only basal joint black, and the middle and hind tibiae yellow. The wings have a discal cloud over posterior cross vein and the apex including tip of marginal cell also infuscate. Length.—2 mm.

*Type.*—♂; Aracataca, Colombia, February 1912, (Ujhelyi), [Hungarian National Museum]. *Paratypes.*—2 ♂, 1 ♀; topotypical.

**Ochtheroidea atra** Williston

1896. *Ochtheroidea atra* Williston, Trans. Ent. Soc. London, 1896, 401.

This species was described from St. Vincent, West Indies, and I have a specimen from Panama, so it is likely to occur in Costa Rica.

The mesonotum is densely granulose and therefore opaque. The scutellum is large and flattened, and the wings are tinged with brown. In color it is similar to *centralis*, but slightly larger in size.

**Ochtheroidea similis** new species

Black; middle and hind tibiae and their tarsi, fore tarsi, except two black apical joints, yellow; halteres white. Wings hyaline with black veins. Shining to nearly polished.

Face more than one-half as broad as vertex, very strongly and rather abruptly convex; facalia distinctly transversely wrinkled. Cheeks at least one-half as high as eyes. Mesonotum and scutellum microscopically granulose. Length.—2.5 mm.

*Type.*—♂; Cachi, Costa Rica, March 7, 1910, (beaches on back channel of Rio Reventazon), [Type No. 6134]. *Paratype.*—1 ♂; topotypical.

**Ochtheroidea laevis** new species

Similar to *glaphyropus*, but larger. Two apical joints of fore tarsi black. Entirely polished, without any apparent sculpturing. Face one-half as broad as vertex, in profile prominent and convex below. Cheeks one-fifth as high as eyes. Length.—2.5 to 3 mm.

*Type.*—♂ ?; Alajuela, Costa Rica, September 15, 1909, (sweeping), [Type No. 6135]. *Paratypes.*—4 specimens, topotypical.

**Ochtheroidea glaphyropus** Loew

1878. *Athyroglossa glaphyropus* Loew, Zeit. f. d. Ges. Naturw., li, 197.

This species has the face and cheeks narrow. The mesonotum is shining although minutely pitted, and the convex scutellum is sometimes nearly scabrous. It will be easily recognized among those with hyaline wings and white fore tarsi. Length.—1.75 mm.

It was described from Texas, but is represented by two specimens in this collection: Bonnefil Farm, Rio Surubres, October 20; Turrucares, Rio Siquiares, December 19.

## LYTOGASTER

1896. Becker, Berl. Ent. Zeit., xli, 202.

A genus readily distinguished by the unusually convex, subhemispherical abdomen, caused by the shortening of the dorsal part of the second and third segments and elongation of the fourth. The lateral margins are revolute, not sharp and not clos-

ing in on the ventral plates. The second and third segments have a more or less distinct, sunken area on their dorsum. The genus should not be confused with *Gastrops*, which has a prominent subhemi-spherical swelling on the face.

The Costa Rican species may be separated as follows:

Scutellum convex, shining, mesonotum smooth; legs entirely yellow. **pallipes**
Scutellum flat, more or less opaque; mesonotum sculptured or opaque.
  Femora and tibiae black ..... **willistoni**
  Legs entirely yellow ..... **granulosus**

**Lytogaster granulosus** Cresson

1914. *Lytogaster granulosus* Cresson, Ent. News, xxv, 249.

Legs entirely yellow, but the scutellum and mesonotum opaque on account of the granulose sculpturing. The abdomen is not so convex as in the other species.

Originally described from Costa Rica.

Represented by 10 specimens from the following localities: In forest near Guapiles, June 4; Near Rio Reventazon at Juan Viñas, June 28; Bonnefil Farm, Rio Surubres, October 20; Upper Reservoir, Banana River, November 9; Beaches on back channel of Rio Reventazon, Cachi, March 7.

**Lytogaster willistoni** Cresson Pl. III, fig. 18.

1916. *Lytogaster willistoni* Cresson, Ent. News, xxvii, 150.

Distinguished by its black legs and antennae, and unusually convex development of the fourth abdominal segment, which is also distinctly pitted and shining.

Originally described from California.

Represented by five specimens from the following localities: Over mud at Cartago, February 19; Laguna del Dirumbo, southern slope of Irazú, July 13; Over mud on southern slope of Irazú, near Cartago, December 15; Along Brook Toyogres on southern slope of Irazú, April 6.

**Lytogaster pallipes** Cresson

1914. *Lytogaster pallipes* Cresson, Ent. News, xxv, 248.

A species distinguished by the shining mesonotum and yellow legs. The abdomen is strongly convex as in *willistoni*. It should not be confused with *granulosus*.

Originally described from Costa Rica.

Represented by nineteen specimens: Cartago, October 27 to May 17; Bonnefil Farm, Rio Surubres, October 20; Over mud at Turrucares, December 22; Beaches of back channel of Rio Reventazon at Cachi, March 7; Stagnant pool, bank of Rio Reventazon near Juan Viñas, March 10; Brook Toyogres on southern slope of Irazú, June 6.

### GASTROPS

1897. Williston, Kans. Univ. Quart., vi, 3.

This genus is characterized by the subhemispherical protuberance on the median area of the face, and the portion below falling vertically. The scutellum in the known species has two apical tubercles. The abdomen is broad, rather circular in outline, with margins revolute and the surface roughened like a rasp file. In many respects its species suggests *Parydra*.

Only one, the following species is known from Costa Rica.

**Gastrops nigra** Williston Pl. III, fig. 10.

1897. *Gastrops niger* Williston, Kans. Univ. Quart., vi, 3, (Brazil).

Black, with antennae and tibiae more or less pale. Thorax polished, not dusted or vittate; scutellum convex and wings immaculate.

Twenty specimens collected from the following localities: Stagnant pools on banks of Rio Reventazon, Cachi, March 10; over brook at edge of forest, Juan Viñas, May 3; over mud at small stream north of Rio Siquiares, December 19 to 22.

### PSILEPHYDRA

1914. Hendel, Suppl. Ent., iii, 99.

This genus is characterized by the peculiar development of the face, which is large, broadly convex, extending well down, appearing somewhat hemispherical. There are no lines or marks defining the orbital areas, cheeks, foveae and such. There are no characteristic facial bristles, but the entire face is clothed with short, decumbent pile and scattered, suberect hair-like bristles. Its systematic position is apparently somewhere in the Ephydrinae. The following species is the only one known besides its congener from Formosa.

**Psilephydra nemorosa** Cresson Pl. III, fig. 26.

1914. *Psilephydra nemorosa* Cresson, Ent. News, xxv, 244.

Entirely shining black with faint submetallic lustre, or somewhat obscured by the sparse brown pollen and the granulate or scrobiculated surface, especially of the thorax and scutellum. Face greenish bronze, appearing golden from the dense yellowish microscopic pubescence. Halteres black. Legs black, with joints and all tarsi except apices, yellowish. Wings immaculate, brownish hyaline.

Apical joint of fore tarsi of male dilated, with fan of long hairs; claws long and stout. Length.—1.5 mm.

Described from six specimens collected along forest brook at Juan Viñas, May 1; Rio Siquiares, Turrucares, December 19.

**NAPAEA**

1830. Desvoidy, Myod. 799.

Synonymous with *Parydra* of authors, but at least subgenerically distinct from *Parydra* of Stenhammar as based on its type species *Ephydra aquila* Fallen. I will treat this genus more thoroughly in my Revision. The Costa Rican species, as known to me, are confined to *Napaea* as based on its type species *Ephydra coarctata* Fallen (*Napaea stagnicola* Desv. syn. by Haliday, 1839).

Only the two following species are known to me from Costa Rica.

**Napaea humilis** Williston

1897. *Parydra humilis* Williston, Kans. Univ. Quart., vi, 7, (South America).

Ocellar bristles well developed. Face brownish, sometimes whitish to golden, gently convex in profile. Posterior dorso-central setulae numerous. Scutellum somewhat narrowed apically; apical bristles with small or minute tubercles. Legs entirely pale. Wings hyaline, without appendages on second vein. Cross veins clouded. Length.—3 mm.

Represented by thirty-one specimens, collected over mud: Cartago, March 1 to May 17; Juan Viñas, February 14; Turrucares, December 22.

**Napaea nigripes** new species Pl. III, fig. 17.

Similar to *humilis* but smaller, with femora entirely, and tibiae largely, black. The face is shorter, less obscured with pollen; mesonotum with about six posterior dorso-centrals setulae. Scutellum narrower, with the bristles more closely situated, without tubercles. Length.—2 mm.

*Type.*—♂; Cartago, Costa Rica, February 19, 1910, (sweeping over mud), [Type No. 6138]. *Paratypes.*—3 ♂, 2 ♀; topotypical.

Also represented by a homotypical series of nineteen specimens collected over mud: Cartago, December 12, 1909 to May 17; Southern slope of Irazú, near Cartago, December 15; Rio de las Cañas, near Santa Cruz, January 30; San Isidro, August 21; Toyogres brook near Tierra Blanca, April 6.

### OCHTHERA

1802. Latreille, Hist. Nat. Crust. Ins., iii, 462.

The species of this genus are easily recognized by the enlargement of the fore femora, which are greatly dilated and flattened as shown in figure. Only one species is known to occur in Costa Rica, but no doubt others will be found.

**Ochthera humilis** Williston Pl. III, fig. 25.

1897. *Ochthera humilis* Williston, Kans. Univ. Quart., vi, 6.

Originally described from South America, and easily recognized by the broad, golden yellow face, bearing the shining black tubercle, and the metallic bronze mesonotal stripes.

One specimen collected over grass muddy road at Peralta, March 24.

### PLANINASUS

1914. Cresson, Ent. News, xxv, 245.

I have not included this genus in the table, as it is probably not an Ephydrid, but possesses many ephydrid characters and is therefore noted here. The preapical tibial bristles are well developed, as well as are the second basal and anal cells. The dorsocentral bristles are in the same series with the prescutellars, and there are two distinct sternopleural bristles. The figure of the head given will help one to recognize the genus. Only the following species is known.

**Planinasus ambiguus** Cresson Pl. III, fig. 28, 29.

1914. *Planinasus ambiguus* Cresson, Ent. News, xxv, 246, pl. x, f. 5 to 7.

Shining black; lunular area, halteres, coxae, basal half of all femora, bases of fore and hind tarsi, yellow; lower part of the oblique facial plate metallic tinged; lower part of face, when seen from above, pale metallic green. Wings brownish hyaline, immaculate. Length.—3 mm.

Described from a male collected in the Valley of Rio Naranjo, Cachi, March 9.

## Subfamily Ephydrinae

Of this subfamily there seems to be few species represented in Costa Rica, or even in South America. The species, in contradistinction with those of Notiphilinae, have the frontal bristles curving laterally over the eyes; the median, lower portion of the face is more or less projecting and satulose, with the facial bristles, if differentiated, arranged in series which converge and are sometimes contiguous above, not paralleling the orbits. The oral opening is large and cavernous.

The genera are characterized sufficiently in the tables and will not be further treated here unless deserving special comment.

### EPHYDRA

**Ephydra rostrata** new name Pl. III, fig. 27.

1896. *Ephydra pygmaea* Williston, Tr. Ent. Soc. London, 1896, 402, (xiii, 147–a), nec *Ephydra* (*Atissa*) *pygmaea* Hal., 1833.

This species is not typical of the genus. It may be distinguished by the unusual prolongation of the lower, convex, sparingly bristled part of the face, which in profile is nearly as long beyond the orbits as the diameter of the eye. It is black, with halteres yellow. All upper surfaces, including the face, are shining, metallic tinged, sparingly dusted with brown. Frontal stripes velvety black.

Only one specimen of this species was collected, along a ditch in Cartago, February 10.

### SCATELLA

**Scatella stagnalis** Fallen Pl. III, fig. 22.

1813. *Ephydra stagnalis* Fallen, Act. Holm., 248.
1849. *Scatella stagnalis* Walker, List, iv, 1104.

This species has the face evenly greenish brown; cheeks, pleura and under surfaces not noticeably gray; wings more or less blackened, with clear or white spots as shown in figure. There is a pair of strong acrostical bristles near the suture, but no strong anterior dorso-centrals.

The specimens examined and determined as this species are smaller than those of the nearctic region, and are more shining

with the wing spots somewhat smaller and rounder, but there seem to be no structural differences.

Twelve specimens collected at Cartago, May 17, to July 4; Rio Reventazon on Irazú, May 24.

**Scatella nitidifrons** new species Pl. III, fig. 23.

This species has the thickened costa in the male, thus resembling the European *callosicosta* Bezzi, and also a similarly characterized species from the United States.

♂. Black; halteres white; wings hyaline, immaculate. Opaque; frons highly polished; mesonotum posteriorly, scutellum and dorsum of abdomen, shining. Face silvery white at oral margin, to black at antennae. Occiput above, antennae and lateral margins of mesonotum, brownish to olivaceous. Cheeks, pleura, lateral margins of abdomen, venter and legs, gray.

Frons and scutellum flat; the latter triangular, rather narrow apically. Costa noticeably thickened between humeral cross vein and tip of first. Third and fourth veins diverging. Length.—1.75 to 2 mm.

♀. Shining areas not so highly polished; face almost entirely silvery; costa and veins normal

*Type.*—♂; Cartago, Costa Rica, May 25, 1909, (along ditch), [No. 6139]. *Paratypes.*—4 ♂, 3 ♀, topotypical.

## SCATOPHILA

**Scatophila variabilis** Cresson

1917. *Scatophila variabilis* Cresson, Ent. News, xxviii, 341, 1917.

Represented by two specimens, one of each sex, collected at Cartago, January 3, and July 4. These specimens belong to a variety with a brown face. As I cannot separate these otherwise from the typical specimens with the white face, I consider them conspecific.

## BRACHYDEUTERA

**Brachydeutera argentata** Walker Pl. III, fig. 24.

1853. *Notiphila argentata* Walker, Ins. Saund., iv, 407.
1862. *Brachydeutera dimidiata* Loew, Mon. Dipt. N. A., i, 162.

The species of this genus are very unique in the short, projecting face, which is seemingly comprised entirely of the deep foveae and the prominent nose like carina. The clypeus is always prominent. The genus is evidently allied to *Ephydra* but not closely.

The species is always recognized by the dark brown, opaque upper, and contrasting gray lower surfaces, especially of the head and thorax. The legs are pale.

Only one specimen examined from Costa Rica: Over muddy road, Peralta, March 24.

EXPLANATION OF PLATE

Fig. 1.—*Notiphila erythrocera*. Profile of head. × 20.
Fig. 2.—*Notiphila erythrocera*. Middle tibia. × 20.
Fig. 3.—*Paralimna meridionalis*. Profile of head. × 20.
Fig. 4.—*Paralimna ciliata*. Fore femur of male. × 20.
Fig. 5.—*Hydrillia spinicornis*. Profile of head. × 20.
Fig. 6.—*Allotrichoma abdominalis*. Profile of head. × 30.
Fig. 7.—*Typopsilopa flavitarsis*. Profile of head. × 25.
Fig. 8.—*Discocerina nitida*. Profile of head. × 20.
Fig. 9.—*Atissiella setulosa*. Profile of head. × 30.
Fig. 10.—*Gastrops nigra*. Profile of head. × 20.
Fig. 11.—*Psilopa meridionalis*. Profile of head. × 20.
Fig. 12.—*Plagiops nitidifrons*. Profile of head. × 25.
Fig. 13.—*Ochthcroidea centralis*. Profile of head. × 25.
Fig. 14.—*Ochthcroidea centralis*. Fore femur of male. × 25.
Fig. 15.—*Nostima slossonae*. Wing. × 25.
Fig. 16.—*Discocerina setulosa*. Profile of head. × 20.
Fig. 17.—*Napaea nigripes*. Profile of head. × 20.
Fig. 18.—*Lytogaster willistoni*. Profile of head and abdomen. × 15.
Fig. 19.—*Ilythea flavipes*. Profile of head. × 30.
Fig. 20.—*Ilythea flavipes*. Wing. × 15.
Fig. 21.—*Ilythea fenestralis*. Wing. × 15.
Fig. 22.—*Scatella stagnalis*. Wing. × 15.
Fig. 23.—*Scatella nitidifrons*. Wing. × 15.
Fig. 24.—*Brachydeutera argentata*. Profile of head. × 20.
Fig. 25.—*Ochthera humilis*. Fore femur and tibia. × 20.
Fig. 26.—*Psilephydra nemorosa*. Profile of head. × 25.
Fig. 27.—*Ephydra rostrata*. Profile of head. × 20.
Fig. 28–29.—*Planinasus ambiguus*. Head. × 25.

# THE GENUS CORYTHUCHA STAL

## (TINGIDAE; HETEROPTERA)

BY EDMUND H. GIBSON
*United States Bureau of Entomology*

Preluding the subject matter of this paper should come an introduction in the form of a tribute to the memory of the late Mr. Otto Heidemann, but, with an insufficient command of eloquence and composition, the author feels restrained from attempting to add more to the several eulogies which have appeared in entomological journals since Mr. Heidemann's death. It was the cherished hope and plan of Mr. Heidemann to revise the family Tingidae, and, with a wealth of material at hand and available for study, he no doubt would have accomplished his purpose in an admirable way, but even as he began he was called to a better land.

In this paper the author has made full use of the notes Mr. Heidemann left and throughout credit is given to him. The author is also extremely appreciative of much valuable advice from Messrs. Howard M. Parshley and Carl J. Drake, and for the generous loan of their collections, as well as those of Messrs. H. G. Barber, J. R. de la Torre Bueno, W. L. McAtee and Edgar L. Dickerson.

With the present paper the total number of described species of *Corythucha* has been brought to fifty-seven. At the time of Van Duzee's check-list, April 24, 1916, there were but fifteen known species. All but one of the fifty-seven species are known to occur in North America, including Mexico; six of them in Central America; two in the West Indies, and two in South America.

Members of the genus are all leaf feeders, but much is yet to be known regarding their host plants. It is quite likely that most of the species have restricted food preferences.

Stål described the genus *Corythucha* in 1873, erecting it upon his *fuscigera*, which is the logotype of the genus.

In regard to separating the species Mr. Heidemann often expressed his belief that the following characters or points should

be given the most weight: position and shape of hood and the height of its crest, the size of its areoles, the constriction on the hood, and also the relative height and length of the median carina. Besides these he recognized the following: size and form of the cells of the elytra, the armature, the rostral groove, the length of the antennae and rostrum. He at one time stated that the male characters were of no use in *Corythucha* and that he could find but little difference in the claspers. In a number of descriptions of new forms which have been recently published, considerable stress has been laid upon the comparative length of the first and second antennal joints. The author can not see the justification of the use of such characters in separating the species, as they are "hair-splitting," and as it has been frequently noted the comparative lengths of the first and second joints will vary considerably with the antennae of the same specimen. General size and intensity of color will also vary to a greater or lesser degree within the species.

The comparative measurements of the pronotal hood and median and lateral carinae are found to be very reliable and stable and, with the relative size of the areoles of hood and paranota and color pattern of elytra, form quite sufficient characters for specific diagnosis. In the key to the species and in their descriptions a sharp difference is made in the phrases, "hood . . . as high as median carina" and "height of hood." The latter applies to the measurement of the hood alone, taken by a line perpendicular to the line of the base of the hood and extending to its crest, while the former is a measurement of the distance from the top of the median carina to the line of the crest of the hood extended and parallel to the line of the body.

In establishing a key to the species, specimens of every species, and with the majority of species the types, have been examined, the key resulting from a direct study of the specimens rather than relying to any extent upon descriptions which in several instances are meager. A redescription of nearly every species has been necessary.

The species are here listed in what appears to be the logical natural order, which is based upon the color pattern of the elytra and general development of the pronotal hood. They may be considered as grouped into five distinct classes, typical of which

are *fuscigera* Stål, *cydoniae* Fitch, *morrilli* Osborn and Drake, *pallida* Osborn and Drake and *immaculata* Osborn and Drake.

Attention is called to the fact that credit should be given to Mr. H. M. Parshley for the species *C. borealis*, *pallipes* and *cryta* herein described as new species, and to Mr. C. J. Drake for *C. elegans*, *betulae*, *occidentalis*, *exigua*, *lactea* and *heidemanni*.

## Food Plant Index

The following list of food plants is given merely as an aid to identification. It is as complete as possible with the data at hand, which was taken from various publications and insect labels:

Alder, common black (*Alnus rugosa*)
  *pergandei* Heidemann
Apple (*Pyrus malus*)
  *caelata* Uhler
  *drakei* Gibson
  *mali* Gibson
Birch, common sweet (*Betula lenta*)
  *pergandei* Heidemann
Birch, yellow (*Betula lutea*)
  *betulae* Drake
Bladder Nut, American (*Stathylea trifolia*)
  *bulbosa* Osborn and Drake
Buckeye (*Aesculus glabrus*)
  *aesculi* Osborn and Drake
Butternut (*Juglans cinerea*)
  *juglandis* Fitch
Buttonbush (*Cephalanthus* species)
  *floridana* Heidemann
Cherry, Wild (*Prunus serotina*)
  *associata* Osborn and Drake
  *pruni* Osborn and Drake
  *spinulosa* Gibson
Cherry, Wild (*Prunus demissa*)
  *padi* Drake
Chrysanthemums
  *marmorata* Uhler
Crab Apple (*Pyrus prunifolia*)
  *pergandei* Heidemann
Currant (*Ribes* species)
  *salicis* Osborn and Drake
Elm (*Ulmus* species)
  *pergandei* Heidemann
  *ulmi* Osborn and Drake

*Eriodictyon californicum*
*eriodictyonae* Osborn and Drake
Hackberry (*Celtis* species)
*celtidis* Osborn and Drake
Hawthorn (*Crataegus* species)
*cydoniae* Fitch
*brunnea* Gibson
Hazelnut (*Corylus americana*)
*coryli* Osborn and Drake
*pergandei* Heidemann
*Heteromeles arbutifolia*
*incurvata* Uhler
Horse Chestnut (*Aesculus hippocastanum*)
*aesculi* Osborn and Drake
*Ichyonethia piscipula*
*gossypii* Fabricius
Juneberry (*Amelanchier intermedia*)
*parshleyi* Gibson
*cydoniae* Fitch
Linden (*Tilia americana*)
*juglandis* Fitch
*pallida* Osborn and Drake
Mullberry (*Morus rubra*)
*pallida* Obsorn and Drake
Oak (*Quercus* species)
*Arcuata* Say
*floridana* Heidemann
*piercei* Gibson
*bellula* Gibson
Peach (*Prunus persica*)
*associata* Osborn and Drake
Pecan (*Carya olivaeformis*)
*parshleyi* Gibson
Poison Oak (*Rhus toxicodendron*)
*coloradensis* Gibson
Quince (*Cydonia vulgaris*)
*cydoniae* Fitch
Red Root (*Ceanothus cardulatus*)
*contaminata* Gibson
*obliqua* Osborn and Drake
Sunflower, Prairie (*Balsamorhiza sagittata*)
*pura* Gibson
Sycamore (*Platanus* species)
*ciliata* Say
*confraterna* Gibson
Thistle, Common or bull (*Carduus lanceolatus*)
*distincta* Osborn and Drake

Thistle (*Cirsium* species)
*distincta* Osborn and Drake
Vetchling (*Lathyrus* species)
*distincta* Osborn and Drake
Walnut (*Juglans* species)
*juglandis* Fitch
*parshleyi* Gibson
Willow (*Salix sieboldiana*)
*pallipes* Parshley
Willow (*Salix* species)
*salicata* Gibson
*salicis* Osborn and Drake
*elegans* Drake

## Distributional Groupings of Species

The grouping as listed below is also as an aid to the identification of species. The definite limits of distribution of only a few species are known, hence the following should be considered merely as a guide:

United States (universally distributed in United States)—*cydoniae* Fitch, *marmorata* Uhler, *pergandei* Heidemann.

Eastern (east of the Rocky Mountains)—*aesculi* Osborn and Drake, *arcuata* Say, *associata* Osborn and Drake, *bulbosa* Osborn and Drake, *celtidis* Osborn and Drake, *ciliata* Say, *contracta* Osborn and Drake, *coryli* Osborn and Drake, *juglandis* Fitch, *pallida* Osborn and Drake, *parshleyi* Gibson, *pruni* Osborn and Drake, *spinulosa* Gibson, *ulmi* Osborn and Drake, *mali* Gibson, *elegans* Drake, *heidemanni* Drake, *betulae* Drake, *bellula* Gibson.

Western (Rocky Mountains and West)—*caelata* Uhler, *coloradensis* Gibson, *confraterna* Gibson, *contaminata* Gibson, *distincta* Osborn and Drake, *drakei* Gibson, *elegans* Drake, *criodictyonae* Osborn and Drake, *hoodiana* Osborn and Drake, *immaculata* Osborn and Drake, *incurvata* Uhler, *morrilli* Osborn and Drake, *obliqua* Osborn and Drake, *padi* Drake, *pura* Gibson, *salicata* Gibson, *piercei* Gibson, *lactea* Drake, *occidentalis* Drake.

Northern —*molliculata* Osborn and Drake, *salicis* Osborn and Drake.

Northeastern (New England States)—*borealis* Parshley, *cyrta* Parshley, *pallipes* Parshley.

Southeastern—*floridana* Heidemann, *salicis* Osborn and Drake.

Southern (Southern United States, Mexico, Central America and South America)—*brunnea* Gibson, *decens* Stål, *fuscigera* Stål, *gossypii* Fabricius, *hispida* Uhler, *mexicana* Gibson, *setosa* Champion, *spinosa* Dugès, *unifasciata* Champion, *fuscomaculata* Stål, *exigua* Drake.

**CORYTHUCHA** Stål

1873. *Corythucha* Stål, Enum. Hem., iii, p. 119.

Pronotal hood entirely concealing the head, with apex reaching a little in front of the head. Rostral sulcus uninterrupted by a transverse carina. Antennae rather long and slender and beset with bristly hairs; first segment at least twice the length of the second; second segment very short; third segment considerably longer than the first two taken together; fourth segment shorter than third, and more or less swollen. Paranota broad, armed on the outer margins with spines. Elytra narrowed at the base with outer margin strongly reflexed anteriorly, with a tumid elevation near the antero-inner margin. The nervures of hood, paranota, and the elytra irregularly armed with a few erect spines.

*Key to the Species*[1]

1. Crest of pronotal hood at least twice as high as median carina.....2.
   Crest of pronotal hood not twice as high as median carina.....22.
2. Costal margins of elytra entirely embrowned.
   *bulbosa* Osborn and Drake (1)
   Costal margins of elytra not entirely embrowned.....3.
3. Length of median carina one-fourth the length of hood, lateral carinae almost obsolete.....**decens** Stål (39)
   Length of median carina distinctly more than one-fourth the length of hood, lateral carinae more or less prominent.....4.
4. Costal margins of elytra distinctly concave.....5.
   Costal margins of elytra nearly straight.....9.
5. Apical portion of elytra crossed by two brown bands.....6.
   Apical portion of elytra crossed by a single band.....7.
6. Species small, narrow.....*morrilli* Osborn and Drake (38)
   Species large, broad.....*lactea* Drake, new species (35)
7. Apical band wide, solid brown.....8.
   Apical band narrow, more or less indistinct.....*incurvata* Uhler (32)
8. Paranota with large brown spot.....*occidentalis* Drake, new species (28)
   Paranota without spot.....*coryli* Osborn and Drake (30)
9. Length of hood noticeably greater than length of median carina.....10.
   Length of hood not greater than length of median carina.....20.
10. Height of hood distinctly greater than length of median carina.
    *associata* Osborn and Drake (4)
    Height of hood not distinctly greater than length of median carina....11.

[1]The number, in parenthesis, occurring after the specific name indicates the order in which its description occurs in the list of species.

11. Species small, less than 3. 5 mm. long....12.
Species large, more than 3. 5 mm. long....14.
12. Crest of hood rounding,....*borealis* Parshley, new species (31)
Crest of hood angulate....13.
13. Two or three apical areoles of elytra entirely hyaline.
*bellula* new species (34)
None of apical areoles entirely hyaline....*brunnea* new species (33)
14. Three large areoles in apical band of elytra entirely hyaline....15.
Three smaller areoles in apical band of elytra not entirely hyaline, partly opaque....16.
15. Crest of hood acute or angulate, top from crest forward straight.
*spinulosa* new species (5)
Crest of hood rounding and top from crest forward convex, not straight.
*cyrta* Parshley, new species (18)
16. Areoles of paranota opaque, creamy; brown markings light.
*elegans* Drake, new species (25)
Areoles of paranota hyaline; brown markings dark....17.
17. Species large, 4 mm. long....18.
Species smaller, less than 4 mm. long....19.
18. Apical band of elytra very wide, one-third the length of elytra.
*betulae* Drake, new species (19)
Apical band of elytra narrow, not more than one fourth the length of elytra....*padi* Drake (22)
19. Paranotal spot large, posterior margin of apical band of elytra straight.
*cydoniae* Fitch (21)
Paranotal spot small, posterior margin of apical band of elytra rounding.
*heidemanni* Drake, new species (20)
20. Reticulations of hood more than twice the size of those of paranota.
*juglandis* Fitch (7)
Reticulations of hood not more than twice the size of those of paranota..21.
21. Hood comparatively high, lateral carinae terminating near to base of hood.
*distincta* Osborn and Drake (8)
Hood comparatively low, lateral carinae terminating far from base of hood.
*pergandei* Heidemann (29)
22. Reticulations of globose portion of hood greater than those of the paranota....23.
Reticulations of globose portion of hood about the same size as those of paranota....48.
23. Height of hood less than one-half of its own length....24.
Height of hood one-half or more of its own length....29.
24. Only color markings on membranous portions are on tumid elevations of elytra....*ciliata* Say (52)
More extensive color markings....25.
25. A distinct brown band across apex of elytra....27.
No distinct brown band across apex of elytra, only a trace of one....26.
26. A distinct brown band across base of elytra....*arcuata* Say (51)
No distinct brown band across base of elytra..*confraterna* new species (53)

27. Hood longer than median carina....28.
Hood shorter than median carina....*obliqua* Osborn and Drake (14)
28. Apical band of elytra wide, one-third the length of elytra, species large.
*pruni* Osborn and Drake (6)
Apical band of elytra narrow, not more than one-fourth the length of elytra, species small....*exigua* Drake, new species (13)
29. Size small, 3 mm. long or less....*floridana* Heidemann (49)
Size larger, more than 3 mm. long....30.
30. Length of hood noticeably shorter than median carina....31.
Length of hood not noticeably shorter than median carina....33.
31. With a distinct dark brown band across base of elytra, and a less distinct one across apex....32.
No distinct dark brown bands or markings on elytra, sometimes a trace of light brown bands....*immaculata* Osborn and Drake (54)
32. Spines on membranous margins long, globose portion of hood narrow.
*unifasciata* Champion (41)
Spines on membranous margins short, globose portion of hood wide.
*contaminata* new species (10)
33. Length of hood noticeably longer than median carina....34.
Length of hood and median carina about equal....40.
34. Width of apical band on elytra one-quarter or less than entire length of elytra....35.
Width of apical band on elytra nearly a third or more the length of elytra. 37.
35. The two or three large areoles in apical band entirely hyaline....36.
The two or three large areoles in apical band clouded, only partially hyaline....*coloradensis* new species (24)
36. Two prominent brown spots on paranota....*fuscomaculata* Stål (23)
A single brown spot on paranota....*parshleyi* new species (12)
37. Apical band of elytra nearly solid brown, excepting two or three hyaline areoles....*aesculi* Osborn and Drake (3)
Apical band not solid brown, many hyaline areoles....38.
38. Distinct brown spot at center of costal margin....39.
No distinct brown spot at center of costal margin..*fuscigera* Stål (2)
39. Lateral carinae terminating near to base of hood.
*mexicana* new species (31)
Lateral carinae terminating far from base of hood..*marmorata* Uhler (36)
40. Distinct brown bands across elytra....41.
No distinct brown bands across elytra, nearly unicolorous.
*pallida* Osborn and Drake (47)
41. Spines along membranous margins and on nervures of hood and elytra very small and comparatively few....42.
Spines of normal length and number....44.
42. Species large, over 4 mm. long....*hoodiana* Osborn and Drake (9)
Species smaller, less than 4 mm. long....43.
43. Hood abruptly constricted....*salicis* Osborn and Drake (17)
Hood constricted but not abruptly so..*molliculata* Osborn and Drake (26)

44. Distinct brown band across apex of elytra.....46.
Without distinct brown band across apex of elytra, nervures may be embrowned but areoles not clouded.....45.
45. Brown spot on paranota large.....*ulmi* Osborn and Drake (42)
Brown spot on paranota small.....*mali* new species (43)
46. Apical band solid brown except for two or three hyaline areoles. *pallipes* Parshley, new species (11)
Apical band not solid brown, very few areoles entirely clouded, many partially hyaline.....47.
47. Paranotal spot large and prominent, hood considerably embrowned. *piercei* new species (16)
Paranotal spot small, not prominent, hood but slightly embrowned. *celtides* Osborn and Drake (15)
48. Median carina extremely low, with never more than one row of small areoles.....49.
Median carina normal height, often two rows of areoles.....52.
49. Pronotal hood constricted.....50.
Pronotal hood not constricted.....*setosa* Champion (48)
50. Spines long and numerous on nervures of membranous portions.....51.
Spines not numerous on membranous portions.....*caelata* Uhler (50)
51. Width of globose portion of hood less than maximum distance between lateral carinae.....*spinosa* Dugès (45)
Width of globose portion of hood as great or greater than maximum distance between lateral carinae.....*eriodictyonae* Osborn and Drake (46)
52. Median carina as high or higher than hood.....*gossypii* Fabricius (40)
Median carina lower than hood.....53.
53. Lateral carinae terminating close against base of hood..*pura* Gibson (55)
Lateral carinae terminating near to base of hood.....54.
54. Spines on membranous margins and nervures numerous, large. *hispida* Uhler (56)
Comparatively few spines on membranous margins and nervures, small. 55.
55. Tumid elevations of elytra well rounded, long....*drakei* new species (44)
Tumid elevations of elytra rather pointed, acute, short. *salicata* new species (27)

1. **Corythucha bulbosa** Osborn and Drake

1916. *Corythucha bulbosa* Osborn and Drake, Ohio Biol. Sur., ii, no. 4, p. 232.

Pronotal hood extremely large and high, more than twice as high as median carina; height equal to more than two-thirds the length of the hood. Hood considerably longer than median carina, not at all flattened on top or posteriorly; abruptly constricted at the middle; globose portion large with its width greater than its length. Reticulations of hood large. Median carina arched, with large areoles. Lateral carinae very small, short, and low without distinct areoles. Costal margins of elytra straight. Spines on membranous margins and nervures very small and dark. Size, 4.6 mm. long, 2.6 mm. wide.

General color dark. Antennae and legs yellowish. Hood embrowned, the center of a few large areoles hyaline. Paranota dark brown. Elytra dark brown, the centers of two large areoles near the apex and a few areoles on inner margins of costal area hyaline.

This is the largest of all the species and easily recognized by the brown costal margins of the elytra. Previous to its being described by Osborn and Drake it was known by the following manuscript names, *carbonata* of Uhler and Heidemann and *staphylea* of Heidemann. It is known to occur on *Staphylea trifolia*, American bladder nut, and its present known range is from Maryland and Virginia west to Ohio. Large series of specimens have been examined, besides the type and paratypes.

2. **Corythucha fuscigera** Stål

1862. *Tingis fuscigera* Stål, Stett. Ent. Zeit., p. 323.
1876. *Corythucha fuscigera* Stål, Enum. Hem., iii, p. 122.
1873. *Monanthia lucida* Walk., Cat. Hem. Het., vi, p. 191.

Pronotal hood higher but not twice as high as the median carina, its height is two-thirds the length of the hood. Length of hood greater than length of median carina. Hood abruptly constricted, the globose portion wider than long, not flattened on top or posteriorly. Reticulations of hood large. Median carina with large areoles. Lateral carinae of medium height, cloudy, and terminating a considerable distance from base of hood. Costal borders of elytra straight. Spines short, numerous on border of paranota. Length 4.5 mm., width 2.5 mm.

Membranous portions hyaline marked with brown. Nervures yellow. Hood more or less embrowned. Two brown spots on paranota. Tumid elevations of elytra with brown spot. Brown bands across base and apex of elytra. Two hyaline areoles in apical band.

The species ranges from New Jersey west to Colorado and Arizona and south through Mexico and Central America. Food plant unknown. Many series of specimens have been examined.

3. **Corythucha aesculi** Osborn and Drake

1916. *Corythucha aesculi* Osborn & Drake, Ohio Biol. Sur., ii, no. 4, p. 232.

Pronotal hood somewhat higher than median carina but not twice as high; its height equal to one-half or more of its length and about equal to the length of median carina. Length of hood noticeably greater than length of median carina. Globose portion of hood large, wider than long, and with large areoles. Median carina high and well arched. Lateral carinae small. Costal margins of elytra straight. Spines on membranous borders medium length and numerous, scarce on nervures.

General color dark brown. Hood almost entirely embrowned. Brown band across base and apex of elytra; apical one wide, at least one-third the length of elytra and entirely brown excepting two or three large hyaline areoles.

Nervures yellow. Brown spot on paranota, sometimes appearing as two. Size, 4 mm. long, 2 mm. wide.

This species is second only in size to *bulbosa* Osborn and Drake. The very large hood and wide dense apical band across elytra are characteristic. Osborn and Drake note its occurrence in Ohio, Illinois and Kentucky on buckeye (*Aesculus glabrus*) and states that it hibernates in the adult stage. It is also reported to occur on horse chestnut (*Aesculus hippocastanum*). The type and twenty-two paratypes were examined.

4. **Corythucha associata** Osborn and Drake

1916. *Corythucha associata* Osborn and Drake, Ohio Journal Sci., xvii, no. 1, p. 14.

Hood very large, three times as high as median carina, and nearly as high as long; considerably longer than median carina. Height of hood noticeably greater than length of median carina. Reticulations of hood large. Sides of elytra straight. Spines on membranous margins and nervures moderately long and normally numerous. Size, 4.1 mm. long, 2.4 mm. wide.

Hood embrowned. Brown band across base and apex of elytra. Apical band as wide as one-third the length of elytra, with two or three large hyaline areoles.

Wild Cherry (*Prunus serotina*) and peach are the known food plants of this species. Its occurrence is recorded from New York west and south through Tennessee and Georgia. Specimens studied included the type and fifteen paratypes.

5. **Corythucha spinulosa** new species

Hood twice as high as median carina and noticeably longer. Height of hood equals about two-thirds the length of hood, and not much greater than length of median carina. Median carina with two rows of areoles. Reticulations of hood large. Costal margins of elytra nearly straight. Spines on membranous margins normally long, not numerous on nervures. Size, 4 mm. long, 2.5 mm. wide.

Hood embrowned on top. Nervures of paranota yellow, with only a trace of brown spots. Dark brown band across base and apex of elytra. Apical band slightly less in width than one-third length of elytra. Two or three large hyaline areoles in apical band and several partial hyaline.

Differs from *associata* Osborn and Drake in having a lower hood, fewer spines on nervures, two rows of areoles in median carina, and a narrower apical band across elytra. Distinguished from *cyrta* Parshley in having crest of hood more acute and angulate and top from crest forward nearly straight.

*Type.*—♀, Jamesburg, New Jersey. (H. B. Weiss, collector.) (Collection of H. M. Parshley.) *Allotype.*—♂, same data as type. *Paratypes.*—Two males, Jamesburg, New Jersey. (Collection of H. M. Parshley.) One female and two males, Jamesburg, New Jersey. (Collection of H. B. Wiess.)

Many other specimens from the same locality have been examined. The food plant of this species is Wild Cherry (*Prunus serotina*).

6. **Corythucha pruni** Osborne and Drake

1916. *Corythucha pruni* Osborn and Drake, Ohio Biol. Sur., ii, no. 4, p. 231.

Height of hood less than one-half its own length and but little higher than median carina. Hood longer than median carina. Median carina rather high with two rows of areoles. Reticulations of hood large. Spines on membranous margins and nervures rather short, not numerous. Size, 4.2 mm. long, 2.3 mm. wide.

Nervures yellow, those on hood more or less embrowned. Brown spot on paranota and brown band across base and apex of elytra. Width of apical band slightly less than one-third of elytra, with two or three large hyaline areoles.

The large, long, low hood is characteristic of this species.

Two paratypes in the Drake collection were examined. They were collected on Wild Cherry (*Prunus serotina*) at Washington, District of Columbia, by Prof. Hine. Captures have been recorded from New York south to North Carolina and west to Ohio. The manuscript name *cerasi* of Heidemann refers to this species.

7. **Corythucha juglandis** Fitch

1866. *Corythucha juglandis* Fitch, Third Rept. Ins. N. Y., p. 466.

This species presents the greatest difficulties in its identification, and specimens in nearly every collection examined have been wrongly determined as *juglandis*. There are two quite distinct species which infest the walnut, one of which, *parshleyi*, is here described as new. The fact that these two species occur in the type series in the Fitch collection is probably responsible for the more or less vague conception of *juglandis*. This is the only species in the genus which exhibits any marked variance in the height of the hood as compared to the height of median carina. By far the great majority of specimens examined, the type included, have the hood at least twice as high as the median carina, a few have the hood but slightly higher than the carina, in this respect resembling *parshleyi*. However, *juglandis* is somewhat

smaller than *parshleyi* and has the apical band straight across the elytra, while in *parshleyi* the apical band runs obliquely from the costal margin toward the inner margin of elytra and is narrower.

Pronotal hood at least twice as high as median carina with its height fully two-thirds its own width. Length of hood not noticeably longer than median carina, sometimes slightly so. Reticulations of hood very large, more than twice the size of those of the paranota. Spines normal, rather short. Costal margin of elytra nearly straight. Size 3.3 mm. to 3.8 mm. long, 2 to 2.3 mm. wide.

General aspect above yellow or light brown. A light spot on paranota, sometimes a faint second one. Brown band across base of elytra and another across elytra near apex. Anterior border of apical band straight, not slanting from inner margin of elytra to costal margin.

The type, a male without locality data, in the U. S. National Museum, and a fine series in the Parshley collection have been examined. The species occurs throughout New England and south and west to Kansas and Texas. Its food plants include walnut, butternut, and linden.

8. **Corythucha distincta** Osborn and Drake

1916. *Corythucha distincta* Osborn and Drake, Ohio Journ. Sci., xxvii, p. 13.

1917. *Corythucha distincta* var. *spinata* Osborn and Drake, Ohio Journ. Sci., xxvii, no. 8, p. 301.

Hood at least twice as high as median carina. Length of hood slightly, if any, less than length of carina. Height of hood equals one-half or more its own length. Median carina long, not prominently arched, and with two rows of areoles. Spines on membranous margins and nervures of moderate length. Reticulations of hood not more than twice the size of those on paranota. Lateral carinae large with distinct areoles, and terminating near base of hood.

Hood embrowned. Two prominent brown spots on paranota the hind one being the largest. Distinct brown bands across base and apex of elytra. Apical band with two or three hyaline areoles. A small brown spot at center of costal margin of elytra. Size, 4 mm. long, 2.41 mm. wide.

A paratype and fifteen specimens in the Drake collection have been examined. Type and paratype specimens are from Colorado. Messrs. Osborn and Drake state that specimens were taken on *Carduus lanceolatus* by A. O. Larson in Utah. The range of the species is known to include Washington, Montana, Wyoming, Colorado, Utah and California. The variety *spinata* of the same authors I cannot give varietal rank, as the type specimen differs only in being slightly larger and darker. The specimens in the Drake collection determined as *distincta* var. *spinata*

are comparatively fresh specimens, while those from which the specific description was made are ten years older, hence a fading in color markings, and in these older specimens many of the spines seem to have been rubbed off. Osborn and Drake record their var. *spinata* from "thistle."

9. **Corythucha hoodiana** Osborn and Drake

1917. *Corythucha hoodiana* Osborn and Drake, Ohio Jr. Sci., xvii, no. 8, p. 302.

Height of hood equals one-half its length, and its length about equal to length of median carina. Median carina large, with two rows of areoles and about as high as hood. Lateral carinae rather large with distinct areoles. Reticulations of hood large. Spines on membranous margins and nervures small and scarce. Size, 4.3 mm. long, 2.6 mm. wide.

Nervures yellow. Light brown spot on paranota. Brown band at base and apex of elytra. Apical band with three large hyaline areoles and width about one-quarter the length of elytra.

The species was described from a single specimen taken on Mt. Hood, Oregon. Food plant unknown. Type examined.

10. **Corythucha contaminata** new species

Pronotal hood slightly higher and shorter than median carina, its height is at least one-half its own length. Lateral carinae long with distinct areoles. Reticulations of hood not over twice the size of those of the membranous pronotal margins. Spines on membranous margins small. Size, 3.5 mm. long, 2.3 mm. wide. Nervures of hood embrowned.

Two brown spots on paranota. Brown bands at base and apex of elytra, apical band narrow with several hyaline areoles. Tumid elevations embrowned and a small brown spot at center of costal margin of elytra.

*Type.*—♀, Moscow, Idaho. *Allotype.*—♂, Moscow, Idaho. *Paratypes.*—Three males, Moscow, Idaho. (Collection of U. S. Nat. Museum.)

Other specimens are at hand from Oregon and California, from *Ceanothus cardulatus*. *Contaminata* is a Uhler manuscript name. Osborn and Drake place it synonymous with *distincta*. The author, however, after examining specimens labelled in Uhler's own handwriting, and from his collection, concludes that this is a distinct species. It may be easily separated from *distincta* Osborn and Drake by the comparatively low hood and shorter lateral carinae.

11. **Corythucha pallipes** Parshley, new species

Hood higher but not twice as high as median carina, its height equals to one-half or more of its own length. Length of hood and median carina about equal. Reticulations of hood large. Spines on membranous margins long,

scarce on nervures. Lateral carinae with distinct areoles. Size, 3.5 mm. long, 2.2 mm. wide.

Hood more or less embrowned. A more or less distinct brown spot on paranota. Distinct dark brown bands across base and apex of elytra. Apical band with two or three large hyaline areoles. Width of apical band about one-fourth of elytra.

*Type.*—♀, Stamford, Connecticut. *Allotype.*—♂. Stamford, Connecticut. *Paratypes.*—Five females and one male. Stamford, Connecticut. (Collection of H. M. Parshley.)

The above specimens were captured from *Salix sieboldiana*, an imported species.

12. **Corythucha parshleyi** new species

Pronotal hood slightly higher and noticeably longer than median carina, its height about equal to one-half its own length. Median carina well arched. Lateral carinae short but normally high. Reticulations of hood large. Spines on membranous margins normal length, numerous on nervures on anterior portion of hood. Size, 4 mm. long, 2.3 mm. wide.

Crest of hood embrowned. Only a very faint trace of a brown spot on paranota. Dark brown bands across base and apex of elytra and on posterior portion of tumid elevation. Apical band slightly less in width than one-fourth length of elytra and with three large areoles entirely hyaline. Apical band running up along inner border of elytra.

*Type.*—♀. Hammonton, New Jersey. (H. B. Weiss.) (Collection of H. M. Parshley.) *Allotype.*—♂, same data as type. *Paratypes.*—Seven females and seven males, same data as type.

The above specimens were captured from *Amelanchier intermedia*. One specimen in the Parshley collection is labelled as occurring on walnut.

Named in honor of Mr. Howard M. Parshley, who has taken a very active interest in this genus.

Mr. Drake sent me a single specimen, which appears to be this species, which he states was collected by Prof. R. W. Leiby from pecan at Lake Waccamaw, North Carolina, September, 1915.

13. **Corythucha exigua** Drake, new species

Hood moderately elevated, three times as long as high, moderately constricted back of the middle. Pronotum with the lateral margins very long, moderately broad, armed on the outer margin with numerous spines; median carina rather highly elevated, not quite as high as the hood, with a double

series of cells near the middle; lateral carinae widely separated from the hood, raised anteriorly and with two or three distinct cells. Antennae clothed with a few long hairs. Elytra with the outer margin nearly straight and armed with numerous spines, the costal area with three to four rows of areoles. Length male and female 3.4 mm.; width 2.2 mm.

Color. General color whitish, marked with fuscous. Pronotum brown; paranota, hood and carinae with areolae hyaline; a few of the nervures on the dorsal part of the hood and a small spot on the paranota fuscous. Elytra hyaline, a band near the base, another near the tip (a rather large hyaline spot near the middle), posterior portion of tumid elevation and more or less of sutural area fuscous. Antennae and legs testaceous, the apices brownish. Body beneath brownish and partially blackened.

*Type.*—♀, Collected near Lake Waccamaw, North Carolina, June 9, 1915, by Prof. R. W. Leiby. (Collection of C. J. Drake.) *Paratype.*—♀, same data as type. (Collection of Department of Agriculture of North Carolina, at Raleigh.)

14. **Corythucha obliqua** Osborn and Drake

1916. *Corythucha obliqua* Osborn and Drake, Ohio Jr. Sci., xvii, no. 1, p. 11, Nov., 1916.

Hood slightly higher and noticeably shorter than median carina. Height of hood slightly less than one-half its own length. Lateral carinae rather long. Reticulations of hood not more than twice the size of those of the paranota. Costal margins of elytra straight. Spines on membranous margins rather short, numerous on nervures of hood. Size, 3.45 mm. long, 1.44 mm. wide.

Hood dark brown. Two dark brown spots on paranota. Brown bands across base and near apex of elytra. Apical band appearing very narrow and slanting anteriorly from costal margin.

The type, from Dutch Flats, Placer County, California, and six other specimens from Oregon, in the Drake collection, have been examined. The species also occurs in Idaho. Food plant is *Ceanothus* species.

15. **Corythucha celtidis** Osborn and Drake

1916. *Corythucha celtidis* Osborn and Drake, Ohio Biol. Soc., ii, no. 4, p. 227.

Pronotal hood slightly higher than and about equal in length to median carina. Height of hood one-half its own length. Medina carina not prominently arched. Lateral carinae short. Reticulations of hood large. Spines along membranous margins of normal length and number. Costal margins of elytra straight. Size, 3.6 mm. long, 1.8 mm. wide.

Few nervures on top of hood sometimes embrowned. A small brown spot on paranota, sometimes a trace of a second spot. Dark brown bands across base and apex of elytra. Apical band not solid brown, very few areoles entirely clouded, many partially hyaline.

Five paratypes from Columbus, Ohio, in the Drake collection, and numerous other specimens from Ohio have been examined. Hackberry is given by Osborn and Drake as the food plant of this species.

16. **Corythucha piercei** new species

Very similar to *celtidis* Osborn and Drake, but differing from it in having the brown spot on the paranota distinctly larger and darker and the hood more extensively embrowned. The median carina in *piercei* is also slightly more arched.

Pronotal hood slightly higher than median carina, with its height at least one-half its own length. Hood and median carina equal in length. Reticulations of hood slightly more than twice the size of those of the paranota. Lateral carinae of medium height and short. Spines on membranous margins and nervures numerous and moderately long. Costal margins of elytra nearly straight. Membranous portions hyaline, nervures slightly yellowish. Hood more or less heavily embrowned on top. A large brown spot on anterior portion of paranota. Elytra with distinct basal and apical bands. Apical band not entirely brown, with many partially hyaline areoles. Size, 3.7 mm. long, 2 mm. wide.

*Type.*—♀, Williams, Arizona. (Dr. W. D. Pierce.) (Collection of United States National Museum.) *Allotype.*—♂, same data as type. *Paratypes.*—One female and three males, same data as type.

The species is named in honor of Dr. W. D. Pierce, who collected all stages of the species from *Quercus* species, during August, 1917.

17. **Corythucha salicis** Osborn and Drake

1917. *Corythucha salicis* Osborn and Drake, Ohio Jr. Sci., xvii, no. 8, p. 298.

Pronotal hood high, but not twice as high as median carina and distinctly longer than median carina. Height of hood at least one-half its own length. Median carina rather low, not arched. Lateral carina short. Spines on membranous margins. Reticulations of hood larger than those of paranota. Size, 3.5 mm. long, 1.9 mm. wide.

Membranous portions whitish-hyaline marked with dark brown. Hood more or less embrowned. A rather faint spot on paranota. Elytra with brown bands across base and apex. Apical band only on costal half.

Separable from *molliculata* in its smaller size and hood a little more abruptly constricted. These two species may prove to be the same, but until more specimens can be provided and examined from the type locality of *molliculata*, and that species more definitely determined, it is well to keep them distinct.

The type specimen from Middlesex Falls, Massachusetts, in the Drake Collection, has been examined and also other specimens from Wisconsin and Montana. A report of its occurrence in Florida has also come to hand. It is known to occur on willow and currant.

18. **Corythucha cyrta** Parshley, new species

Very similar to *spinulosa* Gibson, but differing from it in having a more rounded crest of hood with the top line from crest forward convex and rounded, and in having color markings of a lighter brown.

Hood twice as high as median carina but height of hood not noticeably greater than length of carina. Height of hood two-thirds its length, which is noticeably greater than length of carina. Reticulations of hood large. Spines on membranous margins and nervures rather short. Costal margin of elytra straight. Size, 3.7 mm. to 3.9 mm. long, 2.2 mm. wide. Hood more or less embrowned. A brown spot on paranota. Brown band across base and apex of elytra. Three medium sized hyaline areoles grouped together in apical band, forming a large circle.

The food plant is unknown but it has been taken from sphagnum. Records are from Maine and Massachusetts.

*Type.*—♀, Liberty, Maine. (Collection of H. M. Parshley.) *Allotype.*—♂, same data as type. *Paratypes.*—Two females, same data as type.

Other specimens examined are from Fort Kent and Orono, Maine, Beach Bluff and Chester, Massachusetts, and Bretton Woods, New Hampshire.

19. **Corythucha betulae** Drake, new species

Hood large, highly elevated, the length one and one-fourth times the height, abruptly constricted near the middle, the anterior portion narrow and the posterior portion large and nearly globose. Pronotum with the lateral margins rather large, reniform, the outer margins armed with spines; median carina moderately elevated, slightly more than one-third of the height of the hood; lateral carinae raised anteriorly, with three or four distinct cells, widely separated from the hood. Antennae clothed with a few long hairs, the first segment slightly more than twice the length of the second. Elytra with the outer margin nearly straight and armed with spines (except distal third), the costal area with three or four rows of areoles. Wings a little longer than the abdomen. Length 4.3 mm., width 2.65 mm.

Color. Body beneath black, the claspers in the male brownish. Antennae and legs testaceous, the tips of each brownish. Pronotum brownish; paranota with areolae hyaline and the nervures testaceous, except a few nervelets near the middle fuscous. Hood with a few of the nervures partially embrowned,

the areolae translucent. Elytra with a rather broad band near the base, another near the distal end (a few cells hyaline near the middle) brown or light fuscous.

Numerous specimens, taken at various times during the months of July, August and September on yellow birch (*Betula lutea*), by Mr. Drake, near Cranberry Lake, New York. He reports it as probably one of the most common northern tingids.

*Type.*—♀, Cranberry Lake, New York. (Collection of C. J. Drake.)

20. **Corythucha heidemanni** Drake, new species

Hood rather large, abruptly constricted near the middle, one and two-thirds times as long as high, armed with a few spines on the sides, subglobose, the posterior portion large and rather broad. Pronotum with the lateral margins rather broad and long, the margins armed with spines; median carina about one-third as high as the hood, the lateral carinae widely separated from the hood, raised anteriorly and with two or three distinct cells. Elytra with the outer margin nearly straight and armed with spines like most of the other members of the genus; costal area mostly triseriate, three or four extra cells near the base. Claspers strongly curved in the male. Antennae clothed with a few long hairs. Length 3.7 mm., width 2.45 mm.

Color. Abdomen beneath black, the rostral sulcus and bucculae brownish. Legs and antennae yellowish-brown, the tips of each darker. Pronotum dark brown; paranota with a few fuscous markings near the outer margin about the middle, the nervures testaceous and the areolae mostly hyaline. Elytra with a rather broad band near the base, another near the distal end, posterior portion of tumid elevation, and more or less of sutural area, fuscous.

*Type.*—♀, Cranberry Lake, New York. (Collection of C. J. Drake.) *Paratypes* in the collection of the United States National Museum, Ohio State University, and the California Academy of Science.

A common species in the Adirondacks, around Cranberry Lake, New York.

21. **Corythucha cydoniae** Fitch

1861. *Tingis cydoniae* Fitch, Country Gentleman, xvii, no. 7.

1879. *Corythucha arcuata* Comstock (not of Say), Rept. U. S. Dept. Agric., 1879.

1903. *Corythucha arcuata crataegi* Morrill, Psyche, x, p. 132.

1916. *Corythucha crataegi* Osborn and Drake, Ohio Biol. Sur., ii, no. 4, p. 229.

Crest of pronotal hood slightly more than twice as high as median carina, height slightly more than one-half the length of hood, length of hood greater than length of median carina, globose portion with width greater than the

length. Hood not flattened on top or posteriorly. Reticulations of hood large but not extremely so. Hood constricted, making the anterior portion of the hood appear long and narrow, not distinctly triangular. Median carina with areoles, sometimes two rows. Lateral carinae normally high, terminating a considerable distance from base of hood, with areoles. Costal margins of elytra slightly concave. Spines on margins of membranous portions and at apex of hood short. Nervures only spined at apex of hood. Length 3.5 mm., width 1.7 mm.

Antennae, legs, and nervures light yellow. Hood more or less embrowned. Paranota with a large brown spot. Elytra with a brown band at base and one near apex. Inner margin of elytra brown. Apex of elytra hyaline.

It is interesting to note that Prof. J. H. Comstock in the 1879 Report of the United States Department of Agriculture described the egg and immature form, which at that time Prof. P. R. Uhler considered merely a phytophagic form of *arcuata* Say. Later, in 1903, Dr. A. W. Morrill described the eggs under the name *C. arcuata* variety *crataegi*. Then, in 1916, Osborn and Drake raised Morrill's variety to specific rank. *Crataegi* must now go into synonymy, as it has recently come to light that Dr. Asa Fitch described and figured this species under the name *T. cydoniae* in the Country Gentleman, February 14, 1861. Osborn and Drake erroneously quote the International Code in saying that *cydoniae* is invalid because it was described and published in a non-scientific journal.

This species ranges over the entire United States and is also reported from southern Canada. Hawthorn and quince are its native food plants; however, it has been occasionally reported from other trees but in no great numbers.

22. **Corythucha padi** Drake

1917. *Corythucha padi* Drake, Ohio Journal Sci., xxvii, no. 6, p. 215.

Hood twice as high as median carina, with height about two-thirds its length, noticeably longer than median carina. Height of hood not greater than length of median carina. Reticulations of hood large. Spines on membranous margins and nervures rather small, not numerous. Costal margins of elytra nearly straight. Size, 4 mm. long, 2.4 mm. wide.

Brown spot on paranota. Top of hood more or less embrowned. Brown band across base and apex of elytra. Apical band with a few areoles partially hyaline. Apical areoles sometimes appear entirely hyaline.

Species is recorded from Montana, Oregon, Washington, and British Columbia. The host plant is Western Choke Cherry (*Prunus demissa*). The type and eighteen paratypes have been examined.

23. **Corythucha fuscomaculata** Stål

1858. *Tingis fuscomaculata* Stål, Rio Hem., i, p. 63.

1873. *Corythucha fuscomaculata* Stål, Enum., iii, p. 123.

Pronotal hood slightly higher than median carina, and noticeably longer; its height equals more than one-half its own length. Median carina well arched, almost as much as in *gossypii* Fabr. Lateral carinae small. Reticulations of hood very large. Costal margins of elytra nearly straight. Spines on membranous margins and nervures rather long and numerous. Length 3.6 mm., width 2.2 mm.

Nervures of hood embrowned. Two distinct brown spots on paranota. Brown band across base of elytra and another across elytra just behind the large apical cells, which are entirely hyaline. Two or three cells in apical band entirely hyaline.

Two specimens from Brazil in the National Museum collection have been examined. Food plant unknown.

24. **Corythucha coloradensis** new species

Pronotal hood higher than but not twice as high as median carina; one-half to two-thirds as high as its own length. Length of hood noticeably longer than median carina. Median carina arched, with but one row of large areoles. Reticulations of hood large. Spines on membranous margins rather small, scarce on nervures. Size, 3.8 mm. long, 2 mm. wide.

Crest of hood more or less embrowned. Light brown spot on paranota. Brown band across base and apex of elytra. Apical band about one-fourth the length of elytra and directed forwards along inner border. Areoles in apical band only partially hyaline, none entirely so.

*Type*.—♀, Platte Canyon, Colorado. (Dyar and Caudell, May 20, 1901.) (Collection of United States National Museum.) *Allotype*.—♂, same data as type. *Paratype*.—♂, same data as type.

The above mentioned specimens were taken from poison oak. A single specimen is at hand from Wawawai, Washington, and one from Bad Lands, Sioux County, Nebraska, in the Barber collection, has been examined.

25. **Corythucha elegans** Drake, new species

Pronotal hood at least twice as high as median carina and considerably larger. Height of hood more than half its own length and distinctly greater than length of median carina. Crest of hood more or less angulate. Median carina well arched. Lateral carina normal, with areoles. Reticulations of hood about twice the size of those of paranota. Costal margins of elytra nearly straight. Spines on membranous margins small and numerous, numerous on nervures of hood. Size, 3.5 mm. long, 2 mm. wide.

Nervures of hood and paranota embrowned, with areoles more or less clouded with cream. A light brown band across base and apex of elytra. Tumid elevations embrowned. Areoles in apical band more or less opaque, none entirely hyaline.

*Type*.—♀, Poudre Canyon, Colorado. (Collection of C. J. Drake.) *Allotype*.—♂, same data as type. *Paratype*.—♀, same data as type.

During the summer of 1917, Mr. Drake found what seems to be this species occurring quite commonly on willow at Cranberry Lake, New York.

26. **Corythucha molliculata** Osborn and Drake

1916. *Corythucha molliculata* Osborn and Drake, Ohio Jr. Sci., xvii, no. 1, p. 12.

This species was described from a single specimen bearing the locality label—Ag. Coll. Mich. June 12, 1890. Because of the general inadvisability of describing a new species from a single specimen without a known food plant, and because of the broken and missing median carina, a redescription is hardly warranted. Until a large series is procured the author must keep the validity of this species under suspicion. However, the triangular shape of the hood, with but little constriction, may prove sufficient to keep it distinct. Other characters are to be noted from the key.

27. **Corythucha salicata** new species

Pronotal hood slightly higher than median carina. Height of hood about one-half its own length, and length slightly shorter than median carina. Median carina of normal height, not arched. Lateral carinae long, terminating a short distance from base of hood. Recticulations of hood about same size as those of paranota. Spines on membranous margins and nervures small and scarce. Costal margins of elytra nearly straight, slightly constricted at the middle. Size, 3.4 mm. long, 2 mm. wide.

General aspect above white or cream colored. Crest of hood slightly embrowned. Two faint brown spots on paranota. Rather faint brown band across base, which is sometimes obsolete, and apex of elytra with tumid elevations embrowned and rather pointed or acute. A tiny brown spot at center of costal margin of elytra.

This species is very similar to *drakei* new species, but from which it may be separated by the less arched median carina, which is slightly shorter, and by the angulate tumid elevations of elytra.

*Type*.—♀, Hood River, Oregon. (J. C. Bridwell, Aug. 4, 1908.) (Collection of C. J. Drake.) *Allotype*.—♂, same data

as type. *Paratypes.*—One female and six males, same data as type.

28. **Corythucha occidentalis** Drake, new species

Hood highly elevated, slightly longer than high, moderately constricted at the middle, the posterior portion narrowed dorsally. Pronotum with the lateral margins rather broad, reniform, armed with spines on the outer margins; median carina moderately elevated, about one-fourth as high as the hood, composed of either a single series of large areoles or with a few cells divided near the middle and forming a double series; lateral carinae widely separated from the hood, raised anteriorly, with three or four distinct cells. Elytra with large tumid elevation, the outer margin very strongly concave and beset with spines; costal area mostly triseriate, usually a few extra cells near the base. Antennae clothed with a few long hairs, the first segment three times the length of the second. Claspers strongly curved in the male. Length 2.75 mm., width 1.52 mm.

General color brown. Pronotum, a large spot on the paranota, a small spot on the median carina, brown. Hood embrowned. Elytra with a broad band at the base, another near the apex, more or less of the inner margin, and the tumid elevations, brown. Body beneath reddish-brown, in one specimen partially blackened. Eyes black.

*Type.*—♀, Siskiyou County, California. (Collection of C. J. Drake.) *Paratypes.*—One in Drake collection, one in collection of California Academy of Sciences.

29. **Corythucha pergandei** Heidemann

1906. *Corythucha pergandei* Heidemann, Proc. Ent. Soc. Wash., viii, nos. 1 and 2, p. 10.

Pronotal hood higher than median carina, but not twice as high. Its height equals at least one-half its own length. Length of hood about equal to that of median carina. Reticulations of hood large. Lateral carinae rather large, but short. Costal margins of elytra straight. Spines on membranous margins rather short and inconspicuous. Size, never more than 3 mm. long, often slightly less, 1.7 mm. wide.

Nervures of hood and anterior portion of paranota more or less embrowned. A light brown band across base and apex of elytra. Apical band with no areoles entirely hyaline.

The type specimens, which were collected at Washington, District of Columbia, together with many others have been examined. The range of distribution is from the New England States, west to Wisconsin and south to Kansas, California and Texas.

The known food plants include Hazel, Elm, Crab-apple, Black Alder and Sweet Birch.

30. **Corythucha coryli** Osborn and Drake

1917. *Corythucha coryli* Osborn and Drake, Ohio Jr. Sci., xvii, no. 8, p. 299.

Hood at least twice as high as the median carina, and distinctly longer. Height of hood nearly two-thirds its own length. Median carina arched. Reticulations of hood very large. Spines on membranous margins quite long, scarce on nervures. Costal margins of elytra distinctly concave. Small species, 2.8 mm. long, 1.52 mm. wide.

Hood embrowned. Brown band across base and apex of elytra. Apical band with no large hyaline areoles.

This species is noticeably smaller than *incurvata* Uhler, from which it may also be distinguished by the distinct dark apical band on elytra.

The type and two paratypes in the Drake collection have been examined. They were collected on Hazelnut (*Corylus americana*), by Mr. W. L. McAtee, at Plummer's Island, Maryland, 1914.

This species was known to Mr. Heidemann under his manuscript name *bulata*.

31. **Corythucha borealis** Parshley, new species

Pronotal hood at least twice as high as median carina and noticeably longer. Height of hood at least one-half its own length and not noticeably greater than length of median carina. Lateral carinae very low and short. Reticulations of hood larger than those of paranota. Spines normal in size and number. Costal margins of elytra straight. Size, 2.8 mm. long, 2 mm. wide.

Hood more or less embrowned. A light brown spot on paranota. Light brown band across base and apex of elytra. Apical band without any entirely hyaline areoles. Tumid elevations and inner borders of elytra light brown.

*Type.*—♀, Orono, Maine. (Collection of H. M. Parshley.) *Allotype.*—♂, same data as type. *Paratypes.*—Two females, same data as type.

Food plant unknown.

32. **Corythucha incurvata** Uhler

1894. *Corythucha incurvata* Uhler, Proc. Cal. Acad. Sci., iv, p. 280.

Pronotal hood very large, twice as high as median carina, and its height equal to two-thirds the length of the hood. Length of hood considerably greater than length of median carina. Hood abruptly constricted at the middle, globose portion wider than long, not flattened on top or posteriorly. Reticulations of hood large. Median carina arched before. Lateral carinae of medium height, short, terminating a considerable distance from base of hood. Costal margins of elytra distinctly concave. Spines on membranous borders short. Length 3.3 mm., width 2.9 mm.

General aspect above yellowish brown. Membranous portions hyaline with nervures yellow. Crest of hood more or less embrowned. Pronotum proper, brown. Inner border of elytra more or less embrowned. Faint brown band across apex of elytra, tumid elevations more or less brown and a slight brown spot in each anterior-lateral angle of elytra.

The type in the United States National Museum and many other specimens have been studied. This is a western species, occurring in California and Arizona.

*Heteromelei*, a manuscript name of Heidemann, refers to this species. *Heteromeles arbutifolia* is the food plant. An excellent treatise on its life history and description of nymphs was published by M. C. Pemberton.[2]

33. **Corythucha brunnea** new species

Pronotal hood fully twice as high as median carina, its height more than one-half its own length. Top of hood from crest forward slightly concave. Crest very angulate. Median carina distinctly shorter than hood, of medium height. Lateral carinae normal. Reticulations of hood larger than those of paranota. Spines on membranous margins rather short and not at all numerous. Costal margins of elytra nearly straight. Length 3 mm., width 1.8 mm.

General dorsal aspect dark. Nervures brown or yellowish. Hood almost entirely embrowned. Paranota with two dark spots. A wide basal and apical dark brown band across elytra. Apical band fully one-third the length of elytra, and with three large areoles more or less hyaline and others hyaline at their centers.

*Type*.—♀, Alexandria, Louisiana. (Collection of United States National Museum.) *Allotype*.—♂, same data as type. *Paratypes*.—Six female and seven males, same data as type.

The above mentioned specimens were taken from *Crataegus* species. Other specimens from Logansport, Shrevesport and Monroe, Louisiana, and Liberty, San Antonio and Dallas, Texas, have been examined.

34. **Corythucha bellula** new species

Pronotal hood more than twice as high as median carina, its height is more than one-half its own length. Crest of hood distinctly angled. Areoles of hood large. Median carina low, not arched, shorter than length of hood. Lateral carinae normal. Spines on membranous margins normal. Costal margins of elytra straight. Size, 3 mm. long, 1.9 mm. wide.

Color; nervures of hood embrowned; paranota with a distinct brown spot, sometimes a less distinct second spot. Elytra with basal and apical band.

[2] Journ. Econ. Ent., Vol. 4, No. 3, p. 339, 1911.

Apical band slightly more than one-fourth wider than length of elytra. Two or three partially hyaline areoles in apical band. Apical areoles hyaline, differing in this respect from the preceding species.

*Type.*—♀, Tiffin, Ohio. (Col. by C. J. Drake.) (Collection of United States National Museum.) *Allotype.*—♂, same data as type. *Paratypes.*—Nine females, same data as type.

The above mentioned specimens were captured on *Crataegus* species.

35 **Corythucha lactea** Drake, new species

Hood very highly elevated, very abruptly constricted at the middle, the length a little greater than the height. Sides of hood, dorsal surface of the paranota and elytra, outer margins of paranota and elytra, except distal third, armed with rather stout spines. Paranota not very large, reniform. Pronotum with the posterior process small, areolate; median carina highly elevated, a little more than one-third of the height of the hood; lateral carinae widely separated from the hood, strongly raised anteriorly, with two or three distinct areoles. Elytra rather strongly concave on the outer margin, the costal area triseriate. Claspers strongly curved in the male. Length, male 3.15 mm., female 3.85 mm.; width, male 2 mm., female 2.4 mm.

General color lacteous. Hood, pronotum, paranota, carinae and elytra lacteous, a few veinlets sometimes very faintly margined with light brown, and when so the color markings resemble those of *morrilli* Osborn and Drake. Legs and antennae testaceous. Body beneath brownish, sometimes slightly darkened. Eyes black.

*Type.*—♀, Stansbury Island, Great Salt Lake, Utah. (Collection of C. J. Drake.) *Paratypes.* From same locality in collections of Prof. Larson and California Academy of Sciences.

36. **Corythucha marmorata** Uhler

1878. *Corythucha mamorata* Uhler, Proc. Bost. Soc. Nat. Hist., xix, p. 415.

Pronotal hood considerably higher than median carina but not twice as high. Height of hood about two-thirds its length and equal to the length of the median carina. Hood not flattened on top or posteriorly and not prominently constricted at the middle. Length of globose portion greater than its width. Reticulations of hood slightly larger than those of paranota. Median carina arched. Lateral carinae very small, low, short, terminating a considerable distance from base of hood, and without areoles. Costal borders of elytra straight. Width of elytra at apex very nearly equals the width at anterior line of elytra. Spines on membranous margins and on nervures short. Length 3.2 mm., width 1.8 mm.

Antennae and legs yellowish, hood and paranota lacteous; the nervures more or less embrowned with usually a brown spot in center. Elytra lacteous, with the centers of areoles hyaline, with four irregular, transverse, smoky brown bands.

Its range includes the entire United States. Mr. McAtee reports the food plants of this species in the vicinity of Washington, D. C., as being various members of the genus *Aster*. It has been reported as injurious to Chrysanthemums.

Riley's manuscript name *irroratus* refers to this species.

37. **Corythucha mexicana** new species

Pronotal hood high, but slightly less than twice as high as median carina, its height more than one-half its length. Length of hood noticeably greater than length of median carina. Lateral carinae terminating close to base of hood. Reticulations of hood somewhat larger than those of paranota. Spines rather fine, short, but placed close together on membranous margins. Costal margins of elytra rather concave. Size, 2.8 mm. long, 1.7 mm. wide.

Membranous portions hyaline, marked with brown. Nervures of hood and paranota more or less embrowned. Nervures of elytra embrowned in the form of a band across base and a wide one across apex. Many areoles in apical band hyaline. Nervures at center of costal margin of elytra embrowned to form a spot.

*Type*.—♀, Linares, Nuevo Leon, Mexico. (Collection of J. R. Bueno.) *Allotype*.—♂, same data as type. *Paratypes*.—Three females and five males, same data as type.

Three other specimens in Mr. Bueno's collection from San José, Tamaulipas, Mexico, have been examined. Food plant unknown.

38. **Corythucha morrilli** Osborn and Drake

1917. *Corythucha morrilli* Osborn and Drake, Ohio Jr. Sci., xvii, no. 8, p. 298.

Pronotal hood more than twice as high as the median carina and its height at least two-thirds its own length. Length of hood considerably greater than length of median carina. Globose portion of hood longer than broad. Hood gradually narrowed anteriorly but not prominently constricted, nor at all flattened on top or posteriorly. Reticulations of hood not large. Median carina with two rows of areoles. Lateral carinae long, rounding, terminating close to base of hood, and with areoles. Costal margins of elytra concave. Spines along costal border of elytra and paranota, and on nervures medium length, rather numerous but not prominent. Length, 3 mm., width, 1.5 mm.

Hood more or less embrowned, paranota hyaline and tinged with fuscous, becoming a dark spot at middle, which in some specimens is faint or entirely missing. Elytra hyaline crossed with four irregular brown bands. These bands in some specimens are very faint and more nearly approach spots. A few specimens examined have only faint traces of any brown markings and may be considered a pale color form.

The type and seven paratypes as well as innumerable other specimens have been studied. *Morrilli* was a manuscript name

of Heidemann's. It occurs throughout the southwest portion of the United States and Mexico, where it is one of the commonest species of the genus. It is to be found on various cultivated plants and weeds.

39. **Corythucha decens** Stål

1835. *Tingis gossypii* Burmeister (not of Fabricius), Handb. der Ent., ii, p. 259.

1862. *Tingis decens* Stål, Stett. Ent. Zeit., p. 324.

Hood at least twice as high as median carina, which is extremely short, being not more than one-quarter of the length of hood. Hood constricted before the middle, apex quite acute, globose portion large. Height of hood fully one-half the length of hood. Reticulations of hood much larger than those of paranota. Lateral carinae minute, nearly obsolete. Costal margins of elytra more or less concave. Spines on membranous margins and nervures numerous. Size, 3 mm. long, 1.7 mm. wide.

General color aspect yellow. Nervures of hood more or less embrowned. Small brown spot on paranota. Brown band across base of elytra and another across apex. Basal band sometimes confined to anterior-lateral angle of elytra. Apical band wide, about one-third the length of elytra, not closed anteriorly, with large hyaline areoles. A brown spot at center of costal margin of elytra.

The only specimens which I have seen are from Paraiso, Panama Canal Zone, and were collected by Mr. E. A. Schwarz in 1911. Champion, in the Biologia Centrali-Americana, lists its occurrence in North America, Mexico, Central America and West Indies. Food plant unknown.

This species can readily be separated from all others by the extremely short median carina and nearly obsolete lateral carinae. These points are well illustrated in the Biologia Centrali-Americana.

40. **Corythucha gossypii** Fabricius

1794. *Acanthia gossypii* Fabricius, Ent. Syst., iv, p. 78.

1803. *Tingis gossypii* Fabricius, Syst. Rhyng., p. 126.

1868. *Galeatus gossypii* Stål, Hem. Fabr., i, p. 93.

1873. *Corythucha gossypii* Stål, Enum., iii, p. 123.

Pronotal hood as high as or slightly lower than median carina, its height equal to one-half its length. Length of hood considerably less than length of median carina. Hood constricted at the middle but not prominently so, and not noticeably on top or posteriorly. Globose portion of the hood wider than long. Reticulations of hood small. Median carina arched with at least two rows of areoles. Lateral carinae small, terminating a considerable distance

from base of hood, and without distinct areoles. Costal margins of elytra nearly straight. Spines on membranous margins medium length to long. Nervures of hood with numerous spines, and a few scattered ones on nervures of elytra. Length 3 mm., width 1.6 mm.

All membranous portions hyaline, nervures white except those which are embrowned. Antennae and legs yellow. Anterior portion and crest of hood more or less embrowned. A brown spot at middle of the outer border of paranota. A distinct brown spot on each tumid elevation of elytra. Two faint brown streaks from the costal margin of elytra on the anterior half. Two faint brown bands across apical half of elytra, appearing sometimes as mere spots.

Occurs throughout southern United States, Central America and West Indies. Common on cotton and has been captured on *Icthyonethia piscipula*. Numerous specimens have been examined.

41. **Corythucha unifasciata** Champion

1901. *Corythucha unifasciata* Champion, Biol. Cent.-Amer., Hemip., ii, p. 7.

Pronotal hood somewhat higher than median carina, but not twice as high. Height of hood slightly more than one-half its length. Length of hood less than length of median carina. Hood not flattened on top or posteriorly, constricted at the middle. Width of globose portion slightly greater than its length, reticulations large. Median carina with one row of areoles and posterior half low. Lateral carinae of median size with areoles and short spines, and terminating a considerable distance from base of hood. Costal margins of elytra straight. Spines on membranous borders long and stout. Numerous smaller spines on nervures of membranous portions, especially on hood. Length 3.3 mm., width 2 mm.

General dorsal aspect yellowish brown. Membranous areoles hyaline, nervures yellow. Antennae and legs yellow. Crest of the hood more or less embrowned. Two brown spots on paranota. Brown band at base of elytra and a more or less indistinct irregular brown band near apex of elytra.

A few specimens from southern United States, Mexico and Central America have been examined. Food plant unknown.

42. **Corythucha ulmi** Osborn and Drake

1916. *Corythucha pallida* var. *ulmi* Osborn and Drake, Ohio Biol. Surv., ii, no. 4, p. 231.

Hood higher than median carina, but not twice as high, about equal in length to median carina. Height of hood equals one-half its own length. Lateral carinae rather high but short. Reticulations of hood more than twice the size of those of paranota. Spines on membranous margins and on nervures of hood normal length and size. Costal margins of elytra straight. Size, 3.3 mm. long, 1.6 mm. wide.

Nervures all yellow to light brown. Nearly obsolete brown spots on paranota. Brown band across base of elytra, but with no distinct band across apical portion of elytra, nervures may be embrowned but areoles not clouded.

Type and paratypes in the Drake collection examined. They were collected on *Ulmus americana* at Plummer's Island, Maryland, by Mr. W. L. McAtee. Other specimens from New York and South Carolina were examined. Osborn and Drake also report its capture at Lisbon, Ohio. Although resembling *pallida* Osborn and Drake in general color markings, it may be distinguished from *pallida* by the smaller size and having a brown band across base of elytra. Since Osborn and Drake first published a note on *pallida* var. *ulmi*, they also have come to the conclusion that it should be raised to specific rank.

43. **Corythucha mali** new species

Resembling *ulmi* Osborn and Drake. Pronotal hood only slightly higher than median carina and about equal to it in length. Height of hood one-half its own length. Reticulations of hood large, abruptly constricted at the middle. Median carina well arched. Lateral carinae of normal height, with two or three areoles. Lateral margins of elytra nearly straight. Elevations of elytra large. Spines on membranous margins normal. Size, 3.7 mm. long, 2.3 mm. wide.

Nervures of hood somewhat embrowned, not dark. Paranota with a faint brown spot. Elytra with a distinct basal band, but without a distinct apical one, although the nervures in apical portion may be slightly embrowned and one or two areoles slightly clouded.

*Type.*—♀, Lakehurst, New Jersey. (Collection of H. G. Barber.) *Allotype.*—♂ same data as type. *Paratypes.*—Two females and one male, same data as type.

44. **Corythucha drakei** new species

Pronotal hood slightly higher than median carina and slightly shorter. Height of hood equals one-half its own length. Median carina of normal height. Lateral carina long, terminating a short distance from base of hood. Reticulations of hood about same size as those of paranota. Spines on membranous margins and nervures small and scarce. Costal margins of elytra nearly straight. Tumid elevations of elytra well rounded and rather long. Size, 3.6 mm. long, 1.9 mm. wide.

General aspect above light brown. Nervures more or less yellowish to light brown. Only a faint basal band across elytra. Apical band more distinct. Tumid elevations more or less embrowned.

*Type.*—♀, Portland, Oregon. (Collection of C. J. Drake.)

*Allotype.*—♂, same data as type. *Paratypes.*—Two females and four males, same data as type.

The above mentioned specimens were captured from apple trees. Two other specimens from San Diego, California, with E. P. VanDuzee collector label attached, and four specimens from La Fayette, Oregon, have been examined.

Named in honor of Mr. Carl J. Drake, who has manifested a considerable interest in this genus.

45. **Corythucha spinosa** Dugès

1889. *Tingis spinosa* Dugès, La Nat., (2), i, p. 207.

1901. *Corythucha spinosa* Champion, Biol. Cent.-Amer., ii, p. 8.

Pronotal hood slightly higher than median carina, but its height is less than one-half the length of the hood. Hood extremely low and flattened posteriorly from the crest, constricted at the middle, globose portion appearing slightly wider than long. Reticulations of hood and paranota of same size. Median carina longer than length of hood, very low, as low or lower than lateral carinae. Lateral carinae of medium height, rounding and terminating a considerable distance from base of hood. Costal margins of elytra slightly indented at the middle. Spines on borders of membranous portions long and stout. Spines on nervures shorter, numerous on anterior portion of hood. Length 3.8 mm., width 2.3 mm.

General aspect yellow. Nervures yellow, slight brown markings on hood behind crest, two slight brown spots on paranota, irregular faint brown band across elytra near base and another near apex. Center of costal margin of elytra with small brown spot.

Food plant unknown. Has been recorded from Mexico and Central America.

46. **Corythucha eriodictyonae** Osborn and Drake

1917. *Corythucha eriodictyonae* Osborn and Drake, Ohio Jr. Sci., no. 8, p. 302.

Pronotal hood slightly higher than median carina. Length of hood shorter than median carina and height of hood about equal or, if any, slightly less than one-half its own length. Median carina long and low, with but one row of areoles. Lateral carinae high but short. Reticulations of hood the same size as those of paranota. Costal margins of elytra straight. Spines on membranous margins and nervures long, numerous and stout. Hood abruptly constricted. Size, 3.7 mm. long, 2.2 mm. wide.

General color above yellow or light brown. Nervures all yellow, a few at base and near apex of elytra distinctly embrowned. No areoles clouded. General color much resembles that of *pallida* Osborn and Drake. This species very closely resembles *spinosa* Dugès, and with a larger series at hand may prove to be a synonym of that species. The specimens examined are slightly

smaller in general size, with the spines shorter and not quite so numerous on nervures of elytra. Also the globose portion of the hood is smaller and narrower.

The type, seven paratypes, and twenty other specimens in the Drake collection have been examined, as well as many others in the U. S. National Museum and other collections. The food plant of the species is *Eriodictyon californicum*. This species has been noted to occur only in California.

47. **Corythucha pallida** Osborn and Drake

1916. *Corythucha pallida* Osborn and Drake, Ohio Biol. Surv., ii, no. 4, p. 231.

Pronotal hood somewhat higher than median carina, its height equal to one-half its length, and about as long as median carina. Hood not at all flattened, constricted at about the middle with globose portion wider than long, and with very large areoles. Median carina arched, with at least two very large areoles. Lateral carina medium sized and terminating a considerable distance from the base of the hood. Costal borders of elytra straight. Areoles in elytra large, especially so near the apex. Spines prominent, tipped with black, numerous but not especially long. Length 3.8 mm., width 2.2 mm.

Dorsal aspect yellowish, membranous portions hyaline with nervures distinctly yellow. Only color markings are two faint brown bands, one near the anterior line of elytra and the other near the apex of elytra, sometimes lacking. Antennae yellow.

A paratype and innumerable specimens have been studied. Linden (*Tilia americana*) and mulberry (*Morus rubra*) are the known food plants of this species. It ranges from Maryland and Virginia west through Ohio, and southwestward through Tennessee to Arizona. Uhler's manuscript name *adusta* refers to *pallida*.

48. **Corythucha setosa** Champion

1901. *Corythucha setosa* Champion, Biol. Cent.-Amer., Hemip., ii, p. 7.

Pronotal hood low, flat, and appearing long and narrow from above; only slightly higher than median carina which itself is very low, as low or lower than the lateral carinae. Height of hood less than one-half its length. Length of hood noticeably less than length of median carina. Hood is narrowed anteriorly but not constricted. Reticulations of hood small, same size as reticulations of paranota. Lateral carinae about same height as median carina, with areoles, and terminating a considerable distance from base of hood. Costal border of elytra straight. Spines on membranous portions numerous, short and tipped with black. Length 3.5 mm., width 2.2 mm.

General aspect above yellow. Membranous portions hyaline. Nervures all yellow. Pronotum yellow to fuscous. Fuscous spot on each tumid elevation of elytra and one in each anterior-lateral angle of elytra.

A few specimens from Central America have been examined. Its occurrence seems to be restricted to Mexico and Central America. Food plant unknown.

48. **Corythucha floridana** Heidemann

1909. *Corythucha floridana* Heidemann, Bull. Buffalo Soc. Nat. Sci., ix, p. 236.

This species is easily recognized by its minute size, being the smallest species in the genus. Pronotal hood only slightly higher than median carina. Height of hood about one-half its own length. Median carina slightly shorter than hood. Reticulations of hood large. Spines on membranous margins normal, not abundant. Costal margins of elytra straight. Size, 2.4 mm. long, 1.2 mm. wide.

Nervures of hood slightly embrowned. Paranota with one faint brown spot. A light brown band across base of elytra and a mere trace of one across apex. Nervures only in apical band embrowned, areoles hyaline.

Type and allotype, from Bartow and Biscayne Bay, Florida, and several other specimens from Florida examined. Mr. Heidemann reported the species as being taken on *Cephalanthus*. It is also known to occur on oak.

50. **Corythucha caelata** Uhler

1894. *Corythucha caelata* Uhler, Proc. Calif. Acad. Sci., iv, p. 279.

Pronotal hood only slightly higher than median carina. Height of hood less than half its length. Length of hood less than length of median carina. Hood constricted at the middle. Globose portion spherical, anterior portion long and narrow. Reticulations of hood small, same size as those of paranota. Lateral carinae as high as or higher than median carina, with areoles, and terminating a considerable distance from base of hood. Costal margins of elytra slightly concave. Outer spines along costal borders of elytra and borders of paranota and on anterior portion of hood long tipped with black. Length 3.5 mm., width 1.9 mm.

Above whitish or cream. Membranous portions hyaline, nervures white. Faint brown spot behind each tumid elevation of elytra and one in each anterior-lateral angle of elytra. Nervures near apex of elytra slightly and irregularly tinged with brown.

Occurs in the Pacific Coast States and Mexico. Has been recorded upon apple. Type and many specimens have been examined.

51. **Corythucha arcuata** Say

1832. *Tingis arcuata* Say, Hem. New Harm., p. 27.

1903. *Corythucha arcuata* Morrill, Psyche, x, pp. 127 to 132.

Pronotal hood only slightly higher than median carina; height slightly less, if any, then one-half its length. Length of hood and median carina about

equal. Hood flattened somewhat on top. Globose portion of hood slightly wider than long. Hood prominently constricted. Reticulations of hood large, larger than those of paranota. Median carina arched, with at least one large areole next to base of hood, usually with two rows. Lateral carina short and terminating a considerable distance from base of hood, with areoles clouded. Elytra about as wide at apex as at anterior line of elytra, costal borders straight. Spines along costal border of elytra, border of paranota and at apex of hood small, not numerous. Length 3.1 mm., width 1.6 mm.

General dorsal aspect varies from whitish to yellowish and fuscous. Nervures usually yellowish. Antennae and legs yellowish. Hood more or less embrowned. Paranota sometimes unmarked, usually with a brown spot placed anteriorly, sometimes a faint brown spot posteriorly. Brown band at base of elytra and an irregular brown band across apex of elytra sometimes entirely obsolete.

This species has had the manuscript names of *T. querci* of Riley and *betulae* of Heidemann.

It occurs over the entire United States east of the Rocky Mountains. Oak is its native food plant. Innumerable specimens have been studied.

52. **Corythucha ciliata** Say

1832. *Tingis ciliata* Say, Hem. New Harm., p. 27.

1903. *Corythucha ciliata* Morrill, Psyche, x, p. 133.

Pronotal hood only slightly higher than median carina, flattened on top and posteriorly. Height of hood less than one-half its length. Length of hood and median carina about equal, median carina sometimes appears slightly longer. Hood not prominently constricted, reticulations even and not large, about same size as those of paranota. Median carina with two rows of areoles. Lateral carinae large and high, with areoles, but terminating a considerable distance from base of hood. Costal margins of elytra nearly straight. Spines on borders of paranota and elytra and on nervures of hood small. Length 3.75 mm., width 1.6 mm.

Dorsal aspect whitish or hyaline, only brown markings being a spot on each tumid elevation of elytra.

This has long been known as the Sycamore Tingid and is known to occur on it wherever sycamore grows, east of the Rocky Mountains.

53. **Corythucha confraterna** new species

Pronotal hood slightly higher than median carina. Height of hood less than one-half its own length, length shorter than median carina. Median carina long with two rows of areoles. Lateral carinae high and rather long. Reticulations of hood distinctly larger than those of paranota. Spines on

membranous margins and nervures rather long. Costal margin of elytra nearly straight. Size, 3 mm. long, 1.7 mm. wide.

General color above white. Crest and median carina of hood embrowned. Tumid elevations of elytra embrowned posteriorly and nervures on apical portion of elytra more or less yellow or embrowned.

*Type.*—♀, Los Angeles, California. (Collection of United States National Museum.) *Allotype.*—♂, Chico, California. (Collection of United States National Museum.) *Paratypes.*—Two females, one from Chico and one from Santa Barbara, California, also in collection of United States National Museum.

Many other specimens from California and Mexico have been examined. This has previously been determined as a western form of *ciliata* Say, but the author considers it a distinct species separable from *ciliata* by distinct color markings and smaller size. Sycamore is the food plant of this species.

54. **Corythucha immaculata** Osborn and Drake

1916. *Corythucha immaculata* Osborn and Drake, Ohio Journal Sci., xxvii, no. 1, p. 11.

Hood somewhat higher than median carina, but not twice as high, height equals more than one-half its length. Length of hood shorter than median carina. Median carina well arched with two rows of areoles. Lateral carinae large and long, terminating near to base of hood. Costal margins of elytra straight. Tumid elevations of elytra well rounded. Reticulations of hood only slightly larger than those of paranota. Spines on membranous margins and nervures normal in size and number. Size, 4.1 mm. long, 2.5 mm. wide.

General aspect above pure white, immaculate. Sometimes appearing cream yellowish, especially with old specimens. No brown markings.

A paratype from Alameda, California, in the Drake collection, has been examined, and also several other specimens from Washington, Oregon and Montana. Greatly resembles *pura* Gibson, but may be distinguished from it by the larger reticulations of the hood, spines shorter, and larger in general size.

Food plant unknown.

55. **Corythucha pura** Gibson

1917. *Corythucha pura* Gibson, Ent. News, xxviii, no. 6, p. 258.

Pronotal hood higher than median carina, but less than twice as high, its height nearly two-thirds the length of the head. Length of hood equals length of median carina. Hood constricted at middle, globose portion wider than long and more or less flattened posteriorly. Reticulations of hood small, about same size as those of paranota. Median carina with two distinct rows of areoles. Lateral carinae high, long, with areoles, and terminating close to

base of hood. Costal margins of elytra nearly straight. Spines along membranous portions and on nervures numerous and small. Length 3.8 mm., width 2.5 mm.

Above pure white, membranous portions hyaline, only colors showing are the black eyes and yellow antennae and legs.

Type and paratypes were at hand for study.

The species has been recorded only from Washington, possibly occurs throughout the northwest. *Balsamorhiza sagittata*, the prairie sunflower, is the only known food plant.

56. **Corythucha hispida** Uhler

1894. *Corythucha hispida* Uhler, Proc. Cal. Acad. Sci., ser. 2, iv, p. 279.

Pronotal hood slightly higher than median carina, its height one-half of its length, slightly flattened posteriorly. Globose portion of hood small, slightly wider than long. Hood abruptly constricted behind the middle. Reticulations of hood small, equal in size to those of paranota. Median carina slightly longer than pronotal hood with two rows of areoles. Lateral carinae large, terminating near base of hood, and with large areoles. Costal margins straight. Few hairs on antennae. Spines numerous and long, on borders of elytra and paranota; nervures of hood, carinae, elytra, and paranota. Length 3.2 mm., width 1.9 mm.

Dorsal aspect entirely whitish or cream, membranous portions hyaline. Antennae and legs yellow-fuscous.

Food plant unknown. Occurs throughout the south and southwest. Many specimens, including the type, were at hand for study.

57. **Corythucha contracta** Osborn and Drake

1916. *Corythucha contracta* Osborn and Drake, Ohio Biol. Surv., ii, no. 4, p. 230.

The single specimen from which this species was described was evidently injured or dwarfed at the time of the last nymphal molt, as it is noticeably distorted, especially the elytra; and since capture has been otherwise too badly damaged to allow of its being placed with other species. The specimen was collected at Jefferson, Ohio. Food plant unknown.

The author is simply appending this to the foregoing treatment of species, as he considers its recognition as a distinct species unwarranted, but because of damaged condition it cannot be placed as a synonym of any other species.

# CONTENTS

New Aphididae from California. By Albert F. Swain . 1
(Issued March 28, 1918.)

Neotropical Bees, principally collected by Professor Bruner in Argentina. By T. D. A. Cockerell . . . 25
(Issued March 30, 1918.)

Costa Rican Diptera, collected by Philip P. Calvert, Ph. D., 1909–1910. Paper 3.—A Report on the Ephydridae. By E. T. Cresson, Jr. . . . . 39
(Issued April 4, 1918.)

The Genus Corythucha Stål (Tingidae; Heteroptera). By Edmund H. Gibson . . . . . 69
(Issued April 4, 1918.)

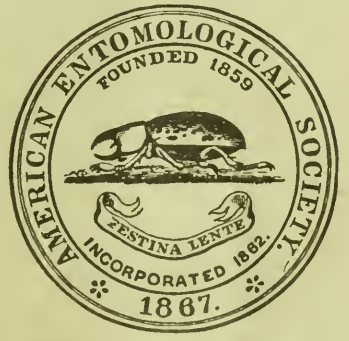
VOLUME XLIV NUMBER 2

JUNE 1918

# TRANSACTIONS

OF THE

# AMERICAN ENTOMOLOGICAL SOCIETY




PUBLISHED BY THE AMERICAN ENTOMOLOGICAL SOCIETY AT THE
ACADEMY OF NATURAL SCIENCES

PHILADELPHIA

SUBSCRIPTION PRICE FOUR DOLLARS PER VOLUME

# THE AMERICAN ENTOMOLOGICAL SOCIETY

PHILADELPHIA

Founded 1859 Incorporated 1862

Organized as "The Entomological Society of Philadelphia," the present title was adopted February 11, 1867.


PRESIDENT
Henry Skinner

VICE-PRESIDENT
James A. G. Rehn

CORRESPONDING SECRETARY
Morgan Hebard

RECORDING SECRETARY
R. C. Williams, Jr.

TREASURER
Ezra T. Cresson

PUBLICATION COMMITTEE
James A. G. Rehn
*Editor*
Ezra T. Cresson
Philip P. Calvert

FINANCE COMMITTEE
James A. G. Rehn
*Chairman*
D. M. Castle
Morgan Hebard

PROPERTY COMMITTEE
Ezra T. Cresson, Jr.
*Librarian* and *Custodian*
Morgan Hebard
Philip Laurent


Meetings held (alternately with those of the Entomological Section of the Academy of Natural Sciences of Philadelphia) on the fourth Thursday of September, October, November, January, February, March, April and May, and on the second Monday of June and December (annual meeting). The offices, meeting room, library and collections of the Society are in the Entomological Department of the Academy of Natural Sciences of Philadelphia, Logan Square.

## SERIAL PUBLICATIONS OF THE SOCIETY

Proceedings of the Entomological Society of Philadelphia, volumes I–VI, 1861–1867. Out of print and cannot be supplied.

Transactions of the American Entomological Society, volumes I–VI, out of print and cannot be supplied; V–X, $5.00 per volume; XI–XLIII, $4.00 per volume. Published in annual volumes of quarterly parts.

The Practical Entomologist, volumes I–II, 1865–1867. Price, $1.00 for the two volumes.

Memoirs of the American Entomological Society, number 1, 1916, price $2.00; number 2, 1917, price $4.50. Published irregularly.

Entomological News, volumes I–XXVIII. Price $2.00 per volume. Published in conjunction with the Entomological Section of the Academy of Natural Sciences of Philadelphia.

Various irregular, non-serial publications have been issued, which may be found in our price lists under their respective authors.

To establish the date of issue, each paper, as soon as completed, is placed on sale and a copy of it is mailed to each of the following institutions, with a request that it be placed in their library for reference.

Boston Society of Natural History
American Museum of Natural History
Smithsonian Institution
Field Museum of Natural History
California Academy of Sciences
Entomological Society of Ontario

Separates of papers published in the Proceedings and Transactions, if not out of print, can be supplied at prices given in our price lists, which are sent upon application, stating order or orders desired. The Society has also inaugurated a system of subscription to papers published by it on individual orders, which arrangement is of material benefit to the student who desires promptly the literature on any special group, but who does not desire to subscribe to entire volumes of the Transactions. A method of notification of the appearance in its publications of papers relating to individual orders or subjects has been developed by the Society. Information concerning these arrangements supplied upon application.

In sending subscriptions or in making inquiries relative to publications, address:

THE AMERICAN ENTOMOLOGICAL SOCIETY,
PUBLICATION DEPARTMENT,
The Academy of Natural Sciences of Philadelphia,
Logan Square.

JUN 28 1918
National Museum.



# A REVISION OF THE NORTH AMERICAN SPECIES OF THE TIPULID GENUS PACHYRHINA MACQUART, WITH DESCRIPTIONS OF NEW SPECIES (DIPTERA)

BY WILLIAM G. DIETZ, M. D.

In his excellent paper on Moravian Tipulidae, Czizek[1] relegates *Pachyrhina* Macquart to the synonymy of *Nephrotoma* Meigen, and, as much as Alexander[2] accepts this view and applies it, it may be well to state the writer's reasons for retaining the generic name *Pachyrhina*. Schiner[3] separated *Nephrotoma* as distinct from *Pachyrhina*. The type and sole European species is *Nephrotoma* (*Tipula*) *dorsalis* Fabricius, and it is differentiated from *Pachyrhina* by the nineteen-jointed antennae of the male (fifteen-jointed in the female). Its Nearctic representative on the Western Continent is *Pachyrhina cucera* Loew. All the other recognized species of *Pachyrhina*, with the exception of *P. polymera* Loew, have thirteen-jointed antennae in the male. Without wishing to invalidate the claim of priority of *Nephrotoma*, I deem it expedient to retain the genus as distinct from *Pachyrhina*. The type of the latter is *P. crocata* Linnaeus, a black species with yellow markings and thirteen-jointed antennae.

From the time of its erection (1834), *Pachyrhina* has been accepted by all writers on the subject, and its relegation to synonymy could only result in confusion without offering any scientific advantage. It is not sharply defined from *Tipula* and its definition, as stated by Alexander[4] and recognized by other investigators, depends rather on an aggregation of characters than any one in particular. Czizek[5] in his work and also Brunetti,[6] have adduced certain venational characters, which if constant, would appear to be decisive.

[1] Tipulidae Moravicae, Zeitschrift des Maerischen Landesmuseums, ii, p. 50, (1911).

[2] Proceedings of the Academy of Natural Sciences of Philadelphia, 1915, p. 465.

[3] Fauna Austriaca, ii, p. 502.

[4] Op. cit., p. 466.

[5] Op. cit., p. 50.

[6] Fauna of British India, p. 340, (1912).

In my investigations of numerous individuals representing a large number of species from within our faunal limits, the hypopygium presents two characters which, independent of others, I consider well-nigh characteristic of the genus. They are, the ninth tergite never longer than wide, generally short, transverse, impressed above mesially, the free margin incised or emarginate in the middle and the lateral angles never acutely extended. The outer apical appendages—upper of Snodgrass—are lanceolate (broadly in *P. oslari*), acuminate, frequently attenuated and incurved beyond the middle. In connection with these hypopygial characters, others will invariably be present to establish the generic status of a given species. These having succinctly been stated by Alexander,[7] I merely wish to comment on some and add others observed by myself:

1. The short and stout proboscis, together with the rather short and stout first antennal joint, mentioned by Schiner,[8] are present in all of our species (except *californica*, mentioned hereafter).

2. The radical sector is longer, semi-oblique, with vein, S. c. ending at some distance beyond its origin (*Pachyrhinae tipuloides*), or else, short and oblique in a variable degree, with vein S. c. ending in close proximity to its origin (*Pachyrhinae* s. s.).

3. The presence generally of S. $c^1$, as a cross vein, in *Pachyrhina*[9] (absent in *oslari*, *hybrida*, partially atrophied in *pachyrhinoides*, *calinota*); absent in *Tipula* (present in *oropezoides*, *dorsolineata*).

4. Cell $M^1$, when sessile or very shortly petiolate, is characteristic when present. A petioled cell $M^1$ occurs frequently and varies considerably in length of its stem, not only in different individuals of the same species, but even in the two wings of the same individual. (Doane[10]). According to Schiner,[11] specimens of *Tipula nigra* occasionally occur, with cell $M^1$ sessile.

[7] Op. cit., p. 466.

[8] Op. cit., ii, p. 503.

[9] Prof. Needham in his "Key to the North American genera of craneflies" (Report of the New York State Museum, 1907, p. 244), says under aa-b-Sc.[1] wanting-Tipulinae. In the footnote, same page, specifically includes *Tipula* and *Pachyrhina*.

[10] Entomological News, 1908, p. 179.

[11] Op. cit., ii, p. 503 footnote.

5. The basal deflection of Cu and the cross vein M-Cu, at or before the fork of M, first mentioned by Czizek[12] and likewise by Brunetti,[13] is somewhat variable and, according to Alexander,[14] approached by certain species of *Tipula*. I here wish to note an instance of its variability. In a series of thirteen specimens of *P.* (*Tipula*) *pachyrhinoides* Alexander, the basal deflection of Cu and the cross vein M-Cu occurs in three specimens before the fork of M, in nine specimens at, and in one specimen after, the fork of M.

Having thus summarized the characters, more or less constant, as distinctive, I have in the present essay included all species under *Pachyrhina* in which the antennae of the male possess less than nineteen joints in the male, having the proboscis short and stout and in which we find the afore-described hypopygial characters.

The habitus of the species with few exceptions is characteristic and needs no further consideration. The species of *Pachyrhina* relegated by Alexander[15] to *Tipula*, are here retained under *Pachyrhina*, except *californica* Doane. This species with its long proboscis, more elongated first antennal joint, and above all the large ninth tergite with greatly extended lateral angles, makes its relegation to *Tipula*, notwithstanding its strong pachyrhinoid appearance, a necessity. The specific name being preoccupied, I propose *xanthomela* in its stead.

In numerous species, at least some of the wing veins are setulose, the setules arranged in regular rows and approximately equidistant from each other. This character is also observed in many *Tipulas* as well as other Tipulidae. The setules are easily removed by friction, but their presence is always indicated by the setigerous punctures. This setulosity is most frequently present on the costal veins, veins R, $R^{1 \text{ and } 2}$ and veins $M^{1, 2 \text{ and } 3}$. The radial sector and the veins limiting cell 1st $M^2$ are almost invariably free, likewise veins Cu and $A^{1 \text{ and } 2}$. The veins are entirely glabrous—free from setules—in *P. oslari* (except R) and

[12] Op. cit., ii, p. 50, (1911).
[13] Op. cit., p. 340, (1912).
[14] Op. cit., p. 466.
[15] Op. cit., p. 466.

others, also in many *Tipulas*, especially the *tricolor* group, *T. rupicola*, *angustipennis*, etc. The setulosity is present on almost all the veins in *P. macrophallus* and *T. oropezoides*. I merely mention this character in order that, with more extensive observations, it may furnish means for the separation of species, or groups.

In concluding these introductory remarks, it is only necessary to state that, separating *Nephrotoma* as distinct from *Pachyrhina*, I have considered the species of the latter under two groups: *Pachyrhinae tipuloides*, which according to Alexander's view would be referrable to *Tipula*, and *Pachyrhinae* s. s. or typical species of the genus.

Species with less than nineteen-jointed antennae in the male.
*Pachyrhina* Macquart

Species with nineteen-jointed antennae in the male.
*Nephrotoma* Meigen

*Synoptic Table of Species*[16]

1. Vein Sc ends at adistance beyond the origin of Rs, the latter longer. Cell $M^1$ never sessile.[17] Vein Cu and cross-vein m-cu after the fork of M ..... **Pachyrhinae tipuloides**. 2
   Vein Sc ends in close proximity to the origin of Rs, the latter short, oblique or subtransverse. Cell $M^1$ sessile or petioled veins Cu and cross-vein m–cu at or before the fork of M ..... **Pachyrhinae** *s. s.* 9
2. Thorax opaque ..... 3
   Thorax shining ..... 6
3. Fuscous or blackish species ..... 4
   Yellowish species ..... 5
4. Thorax and abdomen entirely black; legs robust ..... **oslari** spec. n.
   Pleura and sides of abdomen yellowish-gray; legs slender. **hybrida** spec. n.
5. Thoracic stripes margined ..... **unimaculata** Loew
   Not as in the alternative ..... **macrophallus** spec. n.
6. Thoracic stripes black; stigma brown ..... 7
   Thoracic stripes not black; stigma pale ..... 8
7. Pleura yellow, spotted ..... **nobilis** Loew
   Pleura grayish-fuscous ..... **collaris** Loew
8. Occiput with a median, fuscous line; thoracic stripes ferruginous, not margined ..... **pachyrhinoides** Alexander
   Occiput without line; thoracic stripes gray, margined. **puncticollis** spec. n.
9. Color black, markings, if any, yellow or reddish-yellow ..... 10
   Not as in the alternative ..... 11

[16] Unless otherwise stated, the types of the species described as new are in the author's collection.

[17] See exception noted in the introduction. Schiner. Fauna Austriaca, ii, p. 503, footnote.

10. Abdomen entirely black ..... **altissima** Osten Sacken
Basal portion of abdomen red ..... **erythrophrys** Williston
11. Thoracic stripes black ..... 12
Not as in the alternative ..... 22
12. Anterior end of the lateral thoracic stripes curved outward ..... 13
Not as in the alternative ..... 19
13. The anterior part of the lateral thoracic stripes ends in an opaque or velvety black spot ..... 14
Not as in the alternative ..... 17
14. Occiput with a shining, triangular spot ..... 15
Occiput opaque, yellow ..... **virescens** Loew
15. Sides of pronotal scutum, pleura and abdomen, conspicuously spotted with brown ..... 16
Prenotal scutum and abdomen yellow, pleural spots ochre yellow.
**perdita** spec. n.
16. Occipital spot broadly triangular ..... **incurva** Loew
Occipital spot narrow, prolonged anteriorly ..... **excelsior** Bergroth
17. Wings hyaline, a black spot between the antennae.
**pedunculata** Loew
Wings yellowish-fuscous or infuscate ..... 18
18. Without spot between the antennae; pleura yellow, spotted black; abdomen striped ..... **lineata** Scopoli
A black spot between the antennae; pleura blackish, spotted yellow; abdominal segments two- to five-banded, black ..... **lugens** Loew
19. Wings hyaline ..... 20
Wings brownish ..... **penumbra** Alexander
20. Pleural spots blackish; abdomen without ventral stripe or row of spots.
**vittula** Loew
Pleural spots at most reddish-brown; otherwise not as in the alternative. 21
21. Occipito-frontal vitta broad; a small distinct spot above each eye; stigma well-defined, brown; abdomen with interrupted ventral stripe ..... **snowii** Doane
Occipito-frontal vitta narrow; no supra-orbital spots; stigma ill-defined, pale yellowish-fuscous; abdomen with a row of black spots.
**snowii alternata** subspec. n.
22. Thorax opaque or subopaque ..... 23
Not as in the alternative ..... 31
23. Lateral margin of abdominal tergum and posterior margin of segments banded black ..... **macrocera virgata** subsp. n.
Not as in the alternative ..... 24
24. Antennae of male longer than usual, flagellar joints when bicolored, fuscous at base ..... 25
Antennae of male not longer than usual; flagellar joints fuscous, yellow at base; more rarely unicolorous ..... 27
25. Eighth sternite of male with two digitiform processes ..... 26
Eighth sternite with a median cone-like process.
**macrocera gnata** subspec. n.

26. Wing-surface smooth, without hairs.
*a*. flagellar joints bicolored; wings yellowish. . . . . **macrocera** Loew
*aa*. flagellar joints unicolorous, dark brown, wings dusky.
**macrocera atrocera** var. nov.
Wings hairy. . . . . **pilosula** spec. n.
27. Inner apical appendages of hypopygium large, conspicuous (see pl. V, fig. 23). . . . . 28
Not as in the alternative (see pl. VI, fig. 27A). . . . . 30
28. Costal cells yellow; flagellar joints fuscous, yellow at base. . . . . 29
Costal cells brownish; flagellar joints, except those of the base, entirely fuscous . . . . . **okefenoke** Alexander[18]
29. Inner apical appendages of hypopygium stouter, twisted, ending spine-like. . . . . **urocera** spec. n.
These appendages slender, serpentine. . . . . **cornifera** spec. n.
30. The rodlike appendages of the guard of the penis small, inconspicuous (pl. VI, fig. 27B). . . . . **tenuis** Loew
These appendages large, protuberant, strongly geniculate (pl. VII, fig. 28).
**tenuis hamata** subspec. n.
31. Thorax with five, light pruinose stripes. . . . . **pruinosa** Johnson[19]
Not more than three thoracic stripes, the latter sometimes obsolete. . . . . 32
32. The anterior part of the lateral thoracic stripes curved outward and ending in an opaque or velvety black spot . . . . . 33
Not as in the alternative. . . . . 39
33. Occiput opaque, without spot or line. . . . . **punctum** Loew
Not as in the alternative. . . . . 34
34. Flagellar joints bicolorous. . . . . 35
Flagellar joints unicolorous. . . . . 36
35. Occiput with dark median line. . . . . **calinota** spec. n.
Occiput with shining, triangular spot . . . . . **wulpiana** Bergroth
36. Mesonotal scutum with velvety black median stripe. . **opacivittata** spec. n.
Without such a stripe. . . . . 37
37. Median stripe of scutellum and postnotum and large post-alar spot blackish. . . . . **montana** spec. n.
Not as in the alternative. . . . . 38
38. Antennae entirely yellowish; sides of pronotal scutum and spot in pleuro-dorsal suture fuscous. . . . . **evasa** spec. n.
Antennal flagellum dark fuscous; pleuro-dorsal suture without spots.
**nexilis** spec. n.
39. Flagellar joints unicolorous. . . . . 40
Flagellar joints bicolorous. . . . . 51
40. Antennae entirely yellowish. . . . . 41
Flagellum, except basal joints, blackish. . . . . 42
41. Occiput unicolorous. . . . . **festina** spec. n.
Head with dark occipital line. . . . . **temeraria** spec. n.

[18] Washington University Studies, 1915, p. 97.
[19] Bulletin American Museum of Natural History, xxxii, p. 42.

42. Occiput entirely shining....43
Occiput opaque with a shining triangular spot....46
43. Cord clouded....**unifasciata** Loew
Cord not clouded....44
44. Front and occiput unicolorous....45
Front and occiput with a black stripe....**occipitalis** Loew
45. Head yellow; thoracic stripes well defined....**sodalis** Loew
Head dark ferruginous; thoracic stripes ill-defined.
**sodalis nictans** subsp. n.
46. Ends of thoracic suture black....47
Not as in the alternative....50
47. Cells C and Sc fuscous, stigma very slightly infuscate.
**costomarginata** spec. n.
These cells pale, stigma yellowish-fuscous....48
48. Abdominal tergites conspicuously marked with dark fuscous or blackish; the eighth sternite not deeply emarginate....49
Markings inconspicuous or obsolete; the eighth sternite deeply emarginate.
**occidentalis** Doane
49. Abdomen with dorsal row of blotches or spots; the inner apical appendage not prolonged into a slender process....**ferruginea** Fabricius
Latero-posterior margins of abdominal tergites black; the inner apical appendage prolonged into a slender, style-like process; a black dot above each eye....**beutenmuelleri** spec. n.
50. Stigma brownish-yellow....**occipitalis** Doane[20]
Stigma blackish-brown....**gracilicornis** Loew
51. Flagellar joints black at the base....52
Flagellar joints yellow at the base....58
52. Occiput shining....53
Occiput opaque with defined shining triangle....56
53. Outer portion of transverse suture not tinged with black; thoracic stripes ill-defined....54
Not as in the alternative....55
54. Yellow; abdomen with lateral rows of black spots..**xanthostigma** Loew
Ferruginous; abdomen with lateral stripes and segments posteriorly, banded with black....**cingulata** spec. n.
55. Abdomen with dorsal and lateral rows of black spots; wings pubescent.
**obliterata** spec. n.
Abdomen with lateral stripes and segments banded posteriorly with black.
**wyalusingensis** spec. n.
56. Cells C and Sc hyaline....57
These cells colored; stigma yellowish-brown....**suturalis** Loew
57. Stigma subfuscous; abdomen with three rows of black spots.
**abbreviata** Loew
Stigma almost hyaline; abdominal tergites two to five with two pale, fuscous lines; thoracic stripes broad....**lativittata** spec. n.

[20] I here follow Prof. Doane; the occiput varies from shining to subopaque.

58. Antennae thirteen-jointed.....59
Antennae with more than thirteen joints in both sexes. . .**polymera** Loew
59. Lateral stripe and posterior margin of abdominal segments, black.
**approximata** spec. n.
Abdomen with lateral and ventral rows of black spots.....60
60. Segments of antennal flagellum excised beneath; abdomen with dorsal row of spots; eighth sternite with deep, u-shaped emargination.
**brevicornis** Doane
Segments of flagellum cylindroidal; abdomen with dorsal vitta; eighth sternite protuberant, scarcely emarginate. . . . .**stigmatica** spec. n.

**Pachyrhina oslari** spec. n. (Pl. IV, fig. 1., pl. V, fig. 21.)

Tipuloid; entirely black with a grayish-white pruinosity. Flagellar joints of the antennae prolonged beneath at the apex, giving the antennae a serrate appearance. Stigma pale brown.

Male. Length, 11.5 mm.; wing, 12.5 mm.

Head. Face, space about base of antennae, antero-inferior periorbital margin and sides of occiput, densely white pruinose, median space of occiput dull black. Proboscis very short and thick, frontal prolongation beset with black hairs. Antennae robust, short, entirely black, without whorls of setaceous hairs, with a very short, white pubescence on the apical margin of the segments, the apices of segments three to seven extended beneath, less marked in the following segments, joints eleven and twelve longer than the preceding ones, the last joint very slender.

Thorax. Pronotal scutellum sordid yellow; scutum hairy, darker in middle portion. Mesonotal praescutum without hairy vestiture, grayish-pruinose, stripes blackish, broad, the median stripe divided by a dark line, the lateral stripes indistinctly prolonged upon the mesonotal scutum. Scutellum and postnotum grayish-white pruinose with dark median line. Pleura, with the exception of the upper part of the mesopleural sclerite, densely grayish-white pruinose; pleuro-dorsal membrane dark yellowish-brown.

Legs rather robust, of moderate length, brown; coxae densely grayish-white pruinose, femora yellowish-brown, darker towards the apices, pubescence very short, black, appressed; tarsi black. Halteres dark brown, yellowish at base. Wings grayish, broad; Cells C and Sc yellowish, stigma pale yellowish-brown; vein R setulose, vein $Sc^1$ atrophied; venation as in figure.

Abdomen grayish-pruinose except along the dorsum, where its absence leaves a broad black stripe of the ground color; the extreme posterior margin of segments three to eight, whitish, the lateral margins more broadly, yellowish-white. Eighth sternite with a slight emargination in the middle and one on each side. Hypopygium blackish, appendages ferruginous; ninth tergite very short, impressed anteriorly, posterior margin emarginate in the middle, lateral angles acute, upper appendages broadly lanceolate, inflexed; ninth sternite with closed suture; pleural suture absent. Pl. V, fig. 21.

Female. Length, 13 mm.; wing, 12 mm.

Very similar to the male. Antennae shorter and less markedly denticulate. Sides of scutellum and postnotum yellowish. The lateral margin of the abdominal tergites scarcely at all paler. Ovipositor ferruginous, dorsal valves

long, infuscate at base and apex, the latter pointed; lower valves very short, scarcely two-fifths the length of the upper valves, broad, acuminate.

Holotype: ♂; South Park, Colorado. June 20, 1916. (E. J. Oslar.)

Allotype: ♀; topotypic, June 16, 1916.

Paratypes: one male and one female, topotypic; one female; Cochetopa, Colorado, July 3, 1913, (A. K. Fisher).

In appearance this species appears closely allied to *Tipula cervicula* Doane, but the formation of the ovipositor, aside from other characters, easily distinguishes it. Dedicated to Mr. E. J. Oslar.

A badly mutilated specimen, which I collected in this locality —Hazleton, Pennsylvania—is closely allied. The head is deep ferruginous, opaque, antennae missing; thoracic dorsum orange-yellow, stripes as in *oslari;* scutellum, postnotum and base of abdomen, dark orange-yellow. The specimen was immature, the abdomen contracted; it is probably a female.

One paratype in the collection of the United States Biological Survey.

**Pachyrhina hybrida** spec. n. (Pl. V, fig. 22.)

Closely allied to and congeneric with *P. oslari.* Antennae entirely black; somewhat flattened, not serrate. Underside of head, pleura and sides of abdomen, dark yellowish.

Male. Length, 8.5 mm.; wing, 11 mm.

Head. Dark brown above, underside and proboscis yellowish, periorbital margin yellowish-white; face whitish on the sides, fuscous in the middle; frontal prolongation very short, brown; palpi and mouth parts brown, the former short. Antennae stout, not elongated, entirely black, flagellar joints scarcely longer than wide, somewhat flattened, the last joint long, slender, styloid; the antennae, with the exception of the four basal joints, clothed with a dense pubescence, but without hairs or whorls of bristles.

Thorax. Ground color blackish. The dorsum densely sordid yellowish-pruinose. Pronotal scutellum whitish on the sides; the mesonotal stripes broad, darker, the median stripe wider anteriorly and divided by a dark line; the lateral stripes extending obliquely upon the scutum. Scutellum velvety black anteriorly, brownish-yellow each side posteriorly. Postnotum with median black line. Pleura dark yellowish-gray. Halteres yellowish, infuscate towards the apex, club fuscous, apex grayish-white. Wings grayish, somewhat infuscate, especially in costal portion of the wing; cell $M^1$ with short petiole, otherwise, venation as in *P. oslari*, vein $Sc^1$ present. Legs slender, brown; coxae yellowish-gray, femora towards the base yellowish, and like the tibiae, blackish towards the apex, outer tarsal joints black.

Abdomen shining; dark brown above, tergites three to eight narrowly edged with white posteriorly; sternites one to five or six, dark brown in the middle, remaining sternites yellowish-brown; the lateral parts of tergites and sternites sordid yellow, the seventh sternite emarginate in the middle, the eighth very slightly emarginate. Hypopygium dull yellowish; the ninth tergite very short; outer appendages lanceolate; ninth sternite entire without median suture or incision; the pleural suture appears to be straight. Pl. V, fig. 22.

Holotype: ♂; Denver, Colorado. April 14, 1916. (E. J. Oslar.)

Closely allied to, yet very distinct from, *P. oslari*.

**Pachyrhina macrophallus** spec. n. (Pl. IV, fig. 2; pl. VI, fig. 24.)

Tipuloid. Yellow. Antennae of male elongated. Wings hyaline, stigma fuscous. Penis of unusual length.

Male. Length, 14 mm.—minus penis—; wing, 13.5 mm.

Head yellow. Mouth parts, sides of proboscis and palpi light brown, last joint of the latter scarcely as long as the three preceding joints together; frontal elongation and nasus shining, beset with black hairs which form a pencil at the end of the nasus; remainder of head opaque, face pale yellow, occiput with short, fuscous line. Antennae long and slender, scapal joints yellow, first flagellar joint yellowish-brown, rest of flagellum brown, besides the incomplete verticles of long setaceous hairs at the base of segments, there are many irregularly placed hairs, especially towards the base; pubescence dense, pale; segments cylindroidal, slender.

Thorax. Dorsum feebly shining, pale yellow; pronotal scutum brownish-yellow in middle portion. Praescutal stripes reddish, the median stripe broad and but little narrowed posteriorly, the lateral stripes narrower, not curved anteriorly, leaving the lateral margin free and giving the thorax a margined appearance, stripes very narrowly and indistinctly margined with brown. The lateral stripes are continued upon the scutum, leaving the lateral margin and the middle portion of the latter pale yellow. Scutellum and postnotum darker reddish-yellow, lateral margin and median stripe of the latter, pale yellow. Transverse suture tinged with pale brown in the middle. Pleura reddish-yellow, whitish pruinose, a stripe along the sterno-pleural suture and a few smaller spots pale yellow; the anterior and posterior ends of the pleuro-dorsal suture, black. Halteres yellowish-brown, knob dark brown, apical edge paler. Legs slender, yellowish, pubescense dense, coarse, blackish; femora slightly, tibiae more markedly infuscate at the tip; tarsi blackish, the metatarsi approximately as long as the tibiae. Wings entirely hyaline, stigma brown, preceded by a white, hyaline spot, apical part of wings pubescent, cord at base of cells $R^{2 \text{ and } 3}$ and $R^{4 \text{ and } 5}$, infuscate, all the veins, except vein Cu, more or less setulate. Venation as in figure.

Abdomen yellow, a fuscous dorsal stripe, indistinct anteriorly, irregular, more diffusive and darker posteriorly, an irregular row of black spots along the margin of the tergites; venter, suffused with pale fuscous. The seventh

sternite narrowly, the eighth broadly, V-shaped emarginate. Hypopygium ferruginous, shining; ninth tergite but little wider than long, strongly narrowed posteriorly, with a deep, oval impression in the middle before the posterior margin, the latter with semicircular incision; from below the margin of the latter project two slender, filamentous processes; outer appendages pale yellow, apical two-fifths very slender, curved downward. Penis of unusual length, penis guard semitubular; the gynophores (?) consist of two strongly chitinized plates.

Female. Length, 18 mm.; wing, 13.5 mm.

Antennae relatively short, the flagellar points yellowish-fuscous, dark fuscous at base. The abdominal stripes still more diffused and ill-defined; eighth tergite almost entirely yellow. Ovipositor testaceous, darker in basal portion; valves of nearly equal length, the dorsal pair obtusely, the ventral pair acutely pointed.

Holotype: ♂; Deer Creek, Provo Canyon, Utah. August, 1913. (Tom Spalding.)

Allotype: ♀; topotypic, August 20, 1913.

Paratypes: five males, ten females, topotypic; one female, Milpitas, California, April, 1912, (H. Miller).

In the tipuloid group this form stands rather isolated. In coloration it resembles *P.* (*Tipula*) *pachyrhinoides* Alexander, but is much larger, the thorax less shining and the abdomen striped. In the unusual length of the penis, it differs from any other species of *Pachyrhina* or *Tipula* known to me. The occipital line varies in length and degree of coloring; in same specimens, there is a small fuscous dot each side of the vertex. The California specimen has the thorax subopaque, the dorsal abdominal stripe black, entire; the eight segment and the hypopygium very dark brown.

**Pachyrhina puncticollis** spec. n. (Pl. IV, fig. 3.)

Tipuloid. Sordid yellow. Antennae—male—rather short, flagellum black; a blackish spot each side of base of occiput. Thoracic stripes grayish-pollinose, strongly margined with brown.

Male. Length, 12 mm.; wing, 12 mm.

Head ocher-yellow, shining; mouth parts and palpi brown, the last joint of the latter short. Proboscis short, thick; nasus beset with short, black hairs. Antennae short, stout, bent back they do not reach the alar insertion; basal joint yellow, second joint yellowish-fuscous, flagellum entirely blackish, somewhat compressed, segments of nearly equal thickness, not emarginate beneath or thickened at base, the last three joints attenuated, and longer, a verticel of setae at base of segments; pubescence very fine and short. Frontal gibbosity marked, a fuscous spot on the vertex, close to the orbital margin,

two larger, fuscous, approximate spots at the base of the occiput, two very minute dots at the base of the neck and a larger, black spot each side of the neck.

Thorax sordid yellow. Pronotal scutum fuscous on the sides, scutellum pale fuscous, whitish anteriorly; praescutal stripes grayish-pruinose, wide, heavily margined with brown, the middle stripe divided by an indistinct yellowish line. Scutum with two large, coalescent, grayish-pollinose spots, margined with brown. Scutellum testaceous, shining. Postnotum pale yellow, shining, sides yellowish-fuscous, posterior declivity blackish. Pleura pale yellow with a whitish sheen; inferior half of sternopleura, lower half of mesopleura and some spots, grayish-fuscous. Coxae yellow, the anterior and middle pair anteriorly, the posterior pair on the sides, streaked with dark brown. Legs moderately slender, femora and tibiae yellowish-brown, darker at the apices; tarsi fuscous, metatarsi shorter than the tibiae, the whole leg beset with a very short, appressed, black pubescence. Halteres brownish, base paler, knob fuscous, white at tip. Wings grayish, cells C and Sc fuscous, stigma pale fuscous, vein Cu margined with fuscous, a faint, hyaline spot before the stigma, a similar spot at distal end of cell R, extending through cell 1st $M^2$, into $M^3$, the veins included in this spot are pale. Costal veins and vein R setulose. Venation as in figure.

Abdomen sordid yellow, shining, without stripes or rows of spots. Eighth sternite slightly emarginate. Hypopygium concolorous; ninth tergite brownish at the base, narrowed posteriorly, deeply impressed about the middle and the posterior margin with a semicircular emargination; the outer appendages lanceolate, acuminate; median suture of ninth sternite open; pleural suture curved upward anteriorly.

Holotype: ♂; Clear Creek, Colorado. September 12, 1916. (E. J. Oslar.)

Paratype: ♂; Leadville, Colorado. September 1, 1914. (A. K. Fisher.)

An isolated form, not closely related to any other species known to me. The Radial sector is shorter and more arcuated than usual in this group. The Leadville specimen, has cells C and Sc yellowish; and the ninth tergite is not brown at the base.

Paratype in the collection of the United States Biological Survey.

**Pachyrhina perdita** spec. n.

Yellow. Occiput with shining triangle. Thoracic stripes black, the lateral stripes curved outward and ending in an opaque, black spot. Wings hyaline, stigma black. Cu and crossvein M-cu before the fork of M.

Female?. Length—to end of seventh abdominal segment—15 mm.; wing, 14.5 mm.

Head entirely yellow, proboscis short, frontal prolongation shining, remainder opaque, mouth parts and palpi concolorous, last joint of the latter longer than the three preceding joints together. Antennae of moderate length, basal joint yellow, joints two and three dark yellow, remainder yellowish-brown, finely pubescent, segments cylindroidal, outer joints very attenuated, all with a verticel of setaceous hairs at the base, much longer on the outer joints. A fuscous patch above each eye; a large, fuscous, pentagonal, shining occipital spot; underside of head and portion behind the eyes, pale yellow.

Thorax yellowish-white, opaque. Praescutal stripes black, narrowly edged with ferruginous, shining, the median stripe widened at its anterior end, gradually narrowed posteriorly; the lateral stripes narrower, the anterior end curved outward and ending in a large opaque spot. Scutum with oblique, reddish stripes, infuscate anteriorly. Scutellum testaceous with blackish median groove. Postnotum bone white on the sides, testaceous posteriorly and a large brown patch anteriorly. Outer part of transverse and posterior end of pleuro-dorsal suture black. Pleura bone white, lower part of sterno- and pteropleura and greater part of mesopleura, ocher-yellow. Halteres dull yellowish-white, knob fuscous, paler at tip. Wings hyaline with a faint, grayish tint, stigma brown, basal section of vein $R^{4 \text{ and } 5}$ and cross vein R-M infuscated, apex infuscated, cell $M^1$ with very short petiole. Rs short, slightly curved, oblique; Cu and crossvein M-Cu before fork of M; Sc ends opposite of origin of Rs; $Sc^1$ present.

Abdomen ocher-yellow, extreme base of first tergite blackish, second tergite with two large, irregular, brown patches, tergites three to seven tinged with yellowish-fuscous, the seventh black posteriorly—remainder of abdomen wanting—lateral edges of tergites tinged with fuscous.

Holotype: ♀; Aweme, Manitoba, Canada. August 7, 1913. (E. Criddle.)

From *P. virescens*, *incurva* and *excelsior*, the other three species in which the thoracic stripes are black, the lateral stripes curved outward and ending in an opaque, black spot, the present species differs from *virescens* in the shining, occipital spot, and from *incurva* and *excelsior* in the proboscis, mouthparts and palpi being entirely yellow.

**Pachyrhina snowii alternata** subsp. n.

Differs from true *P. snowii* Doane by its narrow fuscous occipital stripe, absence of spots on the vertex and the pale, ill-defined, yellowish-fuscous stigma. The interrupted abdominal stripes, with the exception of the dorsal stripe of *snowii*, are represented by rows of spots or dashes.

Holotype: ♂; Northwestern Colorado. July 20, 1911. (E. J. Oslar.)

Paratype: ♂; Platte Canyon, Colorado. August 19, 1915. (E. J. Oslar.)

**Pachyrhina macrocera gnata** subsp. n.

The essential difference between this subspecies and true *P. macrocera* Loew, consists in the cone-like prolongation of the eighth sternite of the male of the former, while in true *macrocera*, the eight sternite is emarginate, while the lateral angles of the emargination are prolonged in the form of digitiform processes; of minor importance is the dark, yellowish-fuscous antennal flagellum, the segments dark brown at base and the eighth and ninth tergites of the male nearly entirely fuscous.

Holotype: ♂; Beaver Falls, Wisconsin. August 4, 1909.

**Pachyrhina macrocera atrocera** var. nov.

Agrees in habitus and structural details with true *macrocera*, but is somewhat more somber in appearance. The antennal flagellum is entirely dark brownish black. The seventh abdominal segment apically, the eighth segment and the ninth tergite entirely brown. Structurally, the eighth sternite and hypopygium do not appear to differ from the typical form.

Holotype: ♂; St. Johns, Pennsylvania. July 5, 1917. (W. G. Dietz.)

**Pachyrhina hirsutula** spec. n. (Pl. IV, fig. 4.)

Appearance and habitus of *P. macrocera* Loew. Wings sparsely hairy.

Male. Length, 11.5 mm.; wing, 12.5 mm.

Head yellow; proboscis shining, sides, mouthparts and palpi brown, joints three and four of the latter yellowish-brown, the last joint of moderate length. Antennae long, joints one to three yellow, the third joint nearly twice the length of the two preceding joints together. Joints four and five yellowish-fuscous, remainder dark fuscous; pubescence dense, whitish; verticels of blackish setae at base of segments; occiput opaque, a minute fuscous dot above each eye.

Thorax opaque, dorsal stripes obscure; pleura pale yellow, no markings. Scutellum and postnotum with same luster. Halteres pale yellow, club infuscate, pale at apex. Legs slender, yellow, femora and tibiae slightly darker at the apex, outer tarsal joints infuscate, the metatarsi shorter than the tibiae; pubescence very short, blackish, appressed. Wings hyaline, with faint grayish tint, costal cells yellowish, stigma pale fuscous, costo-apical portion infuscate; surface beset with moderately long, very fine, scattered hairs; costal veins, vein R and all veins beyond the cord, except those which limit cell 1st $M^2$, markedly setulose. Venation as in figure.

Abdomen yellowish-testaceous, shining, brown towards the caudal end, lateral and ventral rows of black spots. Eighth sternite blackish at base, deeply emarginate with a digitiform process from the base of the emargination, the lateral angles of the emargination prolonged into an acute angle. Hypopygium dark testaceous, appendages pale yellow, the outer appendages elongate lanceolate, curved ventrad; inner appendages cone-like and ending in a drawn out point; ninth tergite a trifle wider than long, broadly but not deeply impressed anteriorly, sulcate posteriorly, margin narrowly emarginate in the middle.

Holotype: ♂; Hazleton, Pennsylvania. May 23, 1916.

Paratype: ♂; topotypic.

Very closely resembles *P. macrocera* Loew, from which it differs in the hairy wings; the abdomen strongly infuscate posteriorly and the differently constructed eighth sternite.

**Pachyrhina urocera** spec. n. (Pl. IV, fig. 5; pl. VI, fig. 25.)

Yellowish. Antennae of male not elongate, flagellar joints fuscous, yellow at base. Thoracic dorsum subopaque. Inner apical appendage of hypopygium large, conspicuous, turned outward.

Male. Length, 13.5 mm.; wing, 13.5 mm.

Head sordid yellowish, shining. Mouthparts and palpi yellowish-fuscous, the last joint of the latter shorter than the preceding joints together. Proboscis short, sides infuscate, nasus beset with pale hairs. Antennae not elongate, three basal joints pale yellow, the third joint approximately as long as the two scapal joints, flagellar joints infuscate, yellowish at the base, with a verticel of hairs; pubescence fine, short, whitish. Occiput darker on the sides behind the eyes.

Thorax yellowish-white. Pronotal scutum with a dark line each side. Praescutum subopaque with feeble luster, stripes and space anterior to the parasutural foveae ferruginous, the median stripe somewhat narrowed posteriorly and divided by an indistinct paler line. Scutum with a slight sheen and broad, oblique, ferruginous stripe each side. Scutellum and postnotum brownish-yellow, shining. Pleura and coxae, pale yellow, shining, with whitish sheen. Halteres yellowish towards the base, infuscate apically, knob fuscous, apical edge whitish. Legs long and slender, sordid yellow with dense, fine, appressed, blackish pubescence, tarsi fuscous outwardly, the metatarsi longer than the tibiae. Wings with marked yellow tint, costal cells yellowish-fuscous, stigma fuscous, costo-apical part somewhat infuscate. Veins R and $M^{1, 2 \text{ and } 3}$, very sparsely setulate.

Abdomen dark yellow; tergites one to seven with a pale fuscous, median spot before the middle of the segment; segments three to eight with a black spot each side and a ventral row of similar spots; eighth sternite with V-shaped emargination, the sides and especially the angles, fringed with long, yellow hairs. Hypopygium reddish-yellow, appendages paler; ninth tergite short, a rounded fovea each side of the median line, lateral angles rounded, the posterior margin with semicircular emargination in the middle and fringed with pale yellow hairs; outer appendages lanceolate, claw-like, the apices blackish, attenuated; inner appendages large and conspicuous, twisted, curved down, out, upward and somewhat outward, ending in a blackish spine.

Holotype: ♂; Black Mountains, North Carolina. June 21, 1912. (Wm. Beutenmueller.)

Paratype: ♂; topotypic.

Closely resembles *P. tenuis* Loew and *P. brevicornis* Doane, from both of which it differs in the large, conspicuous, inner

hypopygial appendages, and both of which it resembles in the fuscous, flagellar joints, yellow at the base. The mesonotum is less opaque than in *P. tenuis* but lacks the luster of *P. brevicornis*. The paratype specimen has the thoracic dorsum less opaque and the stripes ill-defined, with the interspaces obliterated. The costal cells are paler. Together with *P. okefenoke* Alexander and *cornifera* sp. n., these three species, because of the greatly developed inner appendages of the hypopygium, form a peculiar group in our Southern States. For differentiation see under *cornifera* and also Table of Species.

**Pachyrhina cornifera** spec. n. (Pl. IV, fig. 6; pl. VI, fig. 25.)

Bone yellow. Flagellar joints, except the two basal joints, brown. Thoracic dorsum opaque. Wings with faint, yellow tinge, stigma dark brown. Abdomen with lateral and ventral rows of black spots. Inner apical appendages of male hypopygium, slender, serpentine, directed laterad.

Male. Length, 14 mm.; wings, 15 mm.

Head pale yellow. Mouth parts and palpi brown. Frontal prolongation shining, beset with pale, yellowish hair; sides of rostrum light brown. Antennae not elongated, basal three joints yellow, fourth joint yellowish-brown, outer joints brown, pubescence pale and rather long, joints cylindroidal, basal whorls of three to five setaceous hairs, the latter long. Occiput shining; an obscure, brownish spot each side of base of neck.

Thorax opaque above, yellow. Pronotal scutum brownish in the middle. Mesonotal stripes yellowish-red, the middle stripe wider and somewhat shining anteriorly, divided by a yellowish median line; all the stripes slightly darker along their margins. Transverse suture not tinged with black. Scutum, scutellum and postnotum ocherous, with some luster. Pleura ocherous with a feeble, whitish pruinosity. Halteres sordid yellow, club pale brown. Legs yellowish, slender, metatarsi longer than the tibiae; outer tarsal joints infuscate. Wings with yellow tint, costal cells and costo-apical part of wing beyond the stigma, deeper yellow; stigma dark brown; veins almost entirely glabrous.

Abdomen sordid yellow, somewhat shining, some obscure dorsal spots, lateral and ventral rows of black spots. Eighth sternite with deep, V-shaped incision, the edges of which are fringed with long, golden-yellow hair. Hypopygium concolorous; the ninth tergite wider than long, tumid each side, the two sides divided by a deep furrow which widens anteriorly and ends posteriorly at the base of the deep, triangular emargination of the posterior margin, each side acutely-triangular at the apex; outer appendages lanceolate, attenuate and incurved apically, the inner appendages are slender, twisted, rod-like, compressed in basal half and directed outward; the rod-like appendages of the penis-guard are strongly marked, claw-like.

Holotype: ♂; Four Mile Run, Virginia. July 24, 1915. (C. P. Alexander.)

Paratypes: three males. Pollochsville, North Carolina. July 8, 1915. (C. P. Alexander.)

In appearance, this species is scarcely distinguishable from *P. urocera* and *P. okefenoke*, except that the outer flagellar joints are entirely brown. However, the form of the peculiar, slender, serpentine, inner apical appendages of the hypopygium easily distinguishes this species from the other two, in which likewise these appendages are strongly developed. The type and one paratype are in the collection of Mr. C. P. Alexander, who kindly placed his material in my hands, two paratypes in author's collection. Cell $M^1$ varies from sessile to moderately long stemmed.

**Pachyrhina tenuis hamata** subsp. n. (Pl. VII, fig. 28.)

Agrees in all essentials with *P. tenuis* Loew. The occiput is subopaque; thoracic dorsum with considerable luster, but differs in the large, geniculate, rod-like appendages of the guard of the penis. There is a rather large, reddish spot in front of the alar insertion, which I have not observed in any specimen of *P. tenuis* at my disposal.

Holotype: ♂; Sullivan County, New York. August, 1912.

**Pachyrhina calinota** spec. n. (Pl. IV, fig. 7.)

Yellow. Frontal prolongation with brown median stripe. Occiput opaque with fuscous line. Thoracic stripes silvery-gray, pruinose, the lateral stripes curved outward and ending in a velvety black spot. Stigma brown.

Male. Length, 13 mm.; wing, 11 mm.

Head. Mouth parts and palpi dark yellow, tinged with fuscous, the last joint of the latter a little longer than the three preceding joints together. Proboscis very short; pale yellow, frontal prolongation with median dark brown stripe extending to end of nasus, the latter densely beset with black hairs. Face and perioribital margin pale yellow. Antennae moderately robust, not elongated, joints one to three sordid yellow, the following joints brownish-yellow, basal enlargement black with a verticel of black setae; pubescence very short, dense, whitish. Front and occiput orange-yellow, opaque, gibbosity marked, a small brown dot behind the antennal insertion; occiput with fuscous line which does not extend to the summit of the gibbosity.

Thorax. Pronotal scutum with median brown spot, sides tinged with fuscous and edged posteriorly with dark brown. Praescutum orange-yellow, opaque, sides paler, stripes silvery-gray pruinose, shining, edged with ferruginous, the median stripe strongly narrowed posteriorly and divided by a black median line; the lateral stripes curved slightly outward anteriorly, with an opaque, blackish spot beneath its anterior end. Scutum sordid yellowish, an oblique stripe each side, similar to those of the praescutum and consisting of two coalescent spots, the antero-exterior of which is the smaller; an elongate

dark brown spot in the middle of the median pale stripe; outer part of transverse suture and its continuation in the pleuro-dorsal suture before the alar insertion, deep velvety black. Scutel yellowish-brown, shining. Postnotum deep yellow, opaque, brownish along median line and posteriorly. Pleura pale yellow with a whitish sheen, lower half of mesopleura ochraceous, a spot in upper portion and several other spots more or less distinct, dark fuscous. Halteres sordid-white, paler at base, knob infuscate, apex white. Wings broad, lightly tinted with gray, basal part yellowish, costal cells brownish-yellow, stigma brown, apex infuscate, cord at base of cells $R^{2 \text{ and } 3}$ and $^{4 \text{ and } 5}$ slightly infuscate. Vein C, Sc, R and its branches, and $M^{1, 2 \text{ and } 3}$ more or less distinctly setulose. Venation as in figure. Legs yellowish, pubescence dense, short and black, femora and tibiae blackish towards the apices, tarsi fuscous, metatarsi about as long as the tibiae.

Abdomen deep yellow, shining, tergites two to six each with a large, brown spot, segment seven nearly, the eighth segment entirely, blackish, lateral margins of tergites indistinctly blackish; venter pale; eighth sternite scarcely emarginate. Hypopygium brown; ninth tergite blackish, very small, bifoveate posteriorly, emarginate in the middle; appendages pale yellow, the outer appendages elongate-lanceolate, incurved, the inner appendages claw-like, curved upwards, their apices projecting under the curved ends of the outer appendages; a carina-like process projects from the suture of the ninth sternite.

Female. Length, 18 mm; wing, 12 mm.

Very similar to the male. Antennae scarcely shorter, lighter yellow. Ovipositor ferruginous; upper valves narrow, obtusely rounded at apex, lower valves two-thirds the length of the upper, broader, rounded at apex.

Holotype: ♂; Floodwood, Schoolcraft County, Michigan. July, 1915. (J. S. Rodgers.)

Allotype; ♀; topotypic.

Paratypes: five males and 7 females, topotypic; two females, Plummer's Island, Maryland, June 8, 1913, (A. Wetmore) and July 14, 1907, (A. K. Fisher).

A very distinct species. From those species having the thoracic stripes not black and the lateral stripes bent outward and ending in a black, opaque spot, it differs, among other characters, from *P. punctum* Loew in its occipital line, and from *P. wulpiana* Bergroth in the absence of a shining triangular spot; from *P. opacivittata*, *montana*, *evasa* and *nexilis* in the bicolored flagellar joints. Specimens in which the pruinosity of the thoracic stripes has been abraded, there have a ferruginous color. Two paratypes are in the United States Biological Survey collection, and a male and a female specimen in Mr. Alexander's collection.

**Pachyrhina opacivittata** spec. n. (Pl. IV, fig. 9.)

Similar to *P. calinota*. Antennal flagellum, except the first joint, blackish. Mesonotal scutum with median, velvety-black stripe.

Male. Length, 12.5 mm.; wing, 12 mm.

Head as in *P. calinota*. Antennae robust, not elongate, scapal joints yellow, third joint yellowish-brown, following joints blackish, strongly emarginate beneath and enlarged at base, with verticel of rather long, black setae, outer joints more elongate, pubescence short, dense and white. Vertex without dots; occipital stripe a little wider and shining.

Thorax as in *P. calinota* with these differences: Pronotal scutum without median brown spot; dorsal stripes ferruginous, without pruinosity; scutum with median, black, velvety stripe. The dark fuscous spot in upper part of mesopleura not distinct. Halteres and legs as in *P. calinota*. Wings broad, with fuscous tinge; cell Sc and margin of Cu and $Cu^1$ brownish; stigma fuscous. Cell 1st $M^1$ open, veins M and $M^3$ in part, atrophied. Veins C, Sc, R and veins $M^{1, 2 \text{ and } 3}$ finely setulose. Venation as in figure.

Abdomen deep yellow with faint luster, basal half of first tergite brown, a pale brown median line posteriorly tergites, two to four with increasingly larger, fuscous patches, similar patches on tergites five and six, pale brown, seventh tergite tinged with fuscous tergites, eight and nine, yellowish brown, a broad, dark brown lateral stripe, less marked on segments seven and eight. Hypopygium similar to that of *P. calinota*, but the inner appendages do not protrude beyond the upper appendages.

Holotype: ♂; Aweme, Manitoba, Canada. (E. Criddle.)

Although very closely resembling *P. calinota*, this species is distinguished at once by its very stout antennae, blackish flagellum, the segments of which are deeply emarginate beneath, the velvety-black vitta of the mesonotal scutum, the subopaque abdomen with broad, lateral stripes. Cell 1st $M^2$ wide open, is certainly anomalous, but, although recorded also in *Tipula imperfecta* Alexander[21] and *Tipula alta*, Doane,[22] no specific value should be attached to it.

**Pachyrhina montana** spec. n. (Pl. IV, fig. 8.)

Allied to *P. calinota*. Frontal prolongation with ferruginous stripe. Antennae, except the first joint, dark brown. Occiput with triangular shining spot. Pleura conspicuously spotted and abdominal tergites banded with dark brown.

Female. Length, 15.5 mm.; wing, 13 mm.

Head yellow. Frontal prolongation shining, with ferruginous median stripe extending to end of nasus, the latter beset with blackish hairs; mouth parts and palpi concolorous, the latter slightly brownish, the last joint shorter than

[21] Proceedings Acad. Nat. Sciences, Philadelphia, 1915, p. 484, pl. xvi, fig. 9.
[22] Annals of the Entom. Society of America, v, p. 44, (1912).

the preceding joints. Face, under side of head and postocular spaces pale-yellowish. Basal joint of antennae yellow, remainder dark brown, joints cylindroidal, setae of basal whorls long, blackish. Occiput orange-yellow, with large, broadly triangular, shining spot.

Thorax pale yellow. Lateral portion of praenotal scutum brown. Praescutum and scutum as in *P. calinota*, but the black, velvety spot at the anterior end of the lateral stripe is larger, the stripes ferruginous, not pollinose, and the scutum is without the median black spot. Scutellum lustrous, ferruginous, with median black stripe. Postnotum opaque, pale yellow on the sides, ocherous posteriorly, with a large, square, shining black spot anteriorly. Pleura concolorous; inferior portion of mesopleura dark brown anteriorly, ferruginous behind; mesopleural suture black; metapleura conspicuously in front, less so behind, and lower angle of ptero-pleura, dark brown. Halteres pale yellowish, knob fuscous. Legs slender, brownish-yellow, outer half of femora blackish, tibiae infuscate towards the apex, shorter than the metatarsi, outer tarsal joints fuscous; pubescence very short, blackish. Wings hyaline, costal cell concolorous, cell Sc pale yellow, basal portion of vein $R^{4 \text{ and } 5}$, cross-vein R-M and apex of wing infuscate; veins C, Sc and R almost imperceptibly setulose. Venation Pl. IV, fig. 8.

Abdominal tergum lemon-yellow, base white, a broad dorsal stripe, less distinct posteriorly and expanding into a transverse fascia on the posterior part of the tergites, dark fuscous; lateral margin of tergites edged with fuscous. Venter whitish, tinted and speckled with fuscous. Ovipositor ferruginous, dorsal valves long and slender, ventral valves a little wider, acutely pointed and scarcely one-half the length of the dorsal valves.

Holotype: ♀; Black Mountains, North Carolina. June, 1912. (Wm. Beutenmueller.)

For differentiation from allied forms, see under *P. calinota*.

**Pachyrhina evasa** spec. n. (Pl. IV, fig. 10.)

Yellow. Antennae entirely yellowish; occiput with shining triangular spot. Abdominal tergites margined posteriorly with yellowish-brown. Thorax similar to *P. montana*.

Female. Length, 18 mm.; wing, 13.5 mm.

Frontal prolongation brown anteriorly. Mouth parts and palpi yellow, last joint of the latter much longer than the three preceding joints. Antennae dark yellow, basal joint a shade paler, outer joints slightly infuscate, verticels of pale yellow setae and distinctly shorter than in *P. montana*. Head otherwise as in the last named species.

Thorax pale yellow. Sides of pronotal scutum dark fuscous. Praescutal stripes ferruginous, the median stripe black in middle half, no pruinosity. Velvety black spot of lateral stripes large. Scutellum ferruginous, shining. Postnotum pale ocherous, subopaque, blackish posteriorly. Outer part of transverse suture and ante-alar part of pleura-dorsal suture, black. Pleura concolorous; intercoxal part of sternopleura and lower portion of mesopleura ocherous, a spot in the pleura-dorsal suture posteriorly and spot of mesosternum

brownish. Mesopleural suture in part, and posterior margin of metapleura tinted black. Halteres and legs as in *P. montana*. Wings with a yellowish tint, more marked in costal cell; cell Sc and margin of Cu and $Cu^2$ yellowish-brown; stigma dark brown, large; apex of wing infuscated, cord and veins $M^3$ and $Cu^2$ margined with fuscous. Venation as in figure.

Abdomen light ocher-yellow; tergites two to six with ill-defined, pale brown, posterior triangle; posterior margin of tergites two to six ferruginous, of tergites seven to eight, blackish; a fuscous lateral stripe. Venter sordid yellowish. Ovipositor as in *P. montana*.

Holotype: ♀; Floodwood, Schoolcraft County, Michigan. July, 1915. (J. S. Royers.)

Easily distinguished from allied species by the sordid yellow antennae. Topotypic with *P. calinota*, it differs, aside from antennal characters, in the broadly triangular, shining occipital spot, the absence of the median black spot of the mesonotal scutum, very distinct in all my specimens of *P. calinota*, and the very different, abdominal markings.

**Pachyrhina nexilis** spec. n. (Pl. IV, fig. 11; pl. VII, fig. 29.)

Yellow. Antennal flagellum dark brown; vertex with three fuscous lines; occiput with broad, triangular, shining spot. Thoracic dorsum as in *P. evasa*. Wings hyaline; stigma dark brown. Median suture of ninth sternite of male with chitinized, pendulous process.

Male. Length, 12 mm.; wing, 11 mm.

Head. Proboscis very short, concolorous; frontal prolongation anteriorly and nasus, brown, the latter beset with black hairs. Mouth parts brown, palpi brownish-yellow, the last joint longer than the preceding joints. Antennae of moderate length, scapal joints orange-yellow, third joint yellowish-brown, paler at base, remaining flagellar joints dark brown, basal enlargement black, elongate and slightly emarginate beneath, last joint very slender, verticels sparsely setulose, pubescence very fine, white. Face and underside of head pale yellow; vertex and occiput orange-yellow, the former with three linear, fuscous spots, the latter with large, broadly-triangular, shining spot.

Thorax sulphur-yellow. Pronotal scutum tinted brownish on the sides. The median praescutal stripe dark brown, edged ferruginous, narrowed posteriorly, the lateral stripes ferruginous with median black line, the velvety black, anterior spot large; scutum with oblique, ferruginous stripe each side, the latter black anteriorly; transverse suture externally and its continuation to alar insertion, black. Scutellum dark yellow, infuscate in the middle. Postnotum sulphur-yellow on the sides, a broad median fuscous patch and ferruginous posterior declivity. Pleura concolorous, lower portion of sternopleura, lower part of mesopleura and metapleura anteriorly and posteriorly, ocherous. Halteres yellowish at base, infuscate toward the knob, the latter dark brown, white at the apex. Legs slender, coxae and basal portion of femora yellowish, the latter darker yellow towards the infuscated apex, tibiae

dark yellow, infuscate apically, tarsi fuscous, metatarsi longer than the tibiae; pubescence very short, blackish. Wings hyaline, costal cells faintly yellow, stigma dark brown, basal section of $R^{4 \text{ and } 5}$, cross vein R–M and apex of wing, infuscate. Costal veins and vein R and $M^{1,2 \text{ and } 3}$ setulose. Venation as in figure.

Abdomen dark yellow, feebly shining, basal part whitish; a broad, not sharply defined dorsal stripe, more or less interrupted at the sutures, dark brown anteriorly, paler posteriorly; seventh and eighth segments almost entirely blackish; a pale fuscous, ill-defined, lateral stripe; eighth sternite slightly emarginate, fringed with long, yellow hairs. Hypopygium; ninth tergite dark ferruginous, wider than long, the lateral angles somewhat prominent, posterior border emarginate on the sides and in the middle, a median impressed line; rest of hypopygium ferruginous; outer appendages pale yellowish, very narrowly lanceolate, attenuated outwardly; inner appendages claw-like, curved upward; between these two appendages is a dark brown, acutely triangular process, pleural suture fine, straight, not curved upward in front; from the middle of the suture of the ninth sternite projects a pear-shaped strongly chitinized appendage, the narrowed end free, dark brown, projects downward.

Holotype: ♂; Clear Creek, Colorado. October 12, 1916. (E. J. Oslar.)

Paratypes: one male, topotypic, July 26, 1915; two males, Bear Creek, Morrison County, Colorado, August 23, 1916.

Quite distinct from the other species. For differentiation from allied species see under *P. calinota*. The three linear fuscous spots of the vertex distinguish this species from all others of this group. In two of the paratypes, the lateral thoracic stripes are entirely ferruginous.

**Pachyrhina festina** spec. n. (Pl. V, fig. 12.)

Pale yellow. Flagellar joints unicolorous, basal joints yellow, outer joints yellowish-fuscous. Occiput shining. Wings with yellowish tint, stigma brown. Abdomen with lateral row of black strigae.

Male. Length, 12.5 mm.; wing, 12.5 mm.

Head pale yellow. Frontal prolongation lustrous, lightly touched with brown anteriorly, nasus beset with pale hairs; mouth parts fuscous; palpi yellowish-fuscous, the two outer joints paler, the last joint scarcely longer than the three preceding joints. Proboscis short, sides brown. Antennae of moderate length, very slender, scapal joints and basal joints of flagellum yellow, outer joints brownish-yellow, cylindrical, pubescence fine, dense, whitish, the hairs of the basal verticels as long or longer than the respective joints. Face and front opaque. Occiput shining, sordid yellowish, with a large, triangular spot which is a shade darker.

Thorax ivory yellow, shining. Pronotal scutum with pale brownish stripe each side of median line; scutellum brownish anteriorly. Lateral praescutal stripes chestnut brown, curved slightly outward, anteriorly; the median stripe reddish-brown, with paler median line, and narrowed posteriorly. Scutum concolorous, polished, each side with two large, coalescent, reddish-brown spots, the antero-exterior spot being the smaller. Scutellum and postnotum concolorous, the former slightly, the latter more markedly, infuscate along the middle. Legs slender, yellowish, pubescence very short, black, appressed, tibiae slightly infuscate at tip, outer joints of tarsi brownish; metatarsi longer than the tibiae. Wings hyaline with yellowish tint, costal cells pale yellow, stigma brown, costo-apical portion somewhat infuscate; veins C, Sc and Cu yellowish, others brown. Costal veins, vein R and veins $M^{1,2 \text{ and } 3}$, finely and sparsely setulose. Venation as in figure.

Abdomen sordid yellow, shining, with ill-defined, pale brown dorsal stripe, the apical half of the seventh and eighth tergite nearly entirely light brown; a lateral row of black strigae. Venter pale, eighth sternite with V-shaped incision, the margin of which is fringed with stiff, yellow hairs, longer and forming a pencil on the somewhat prominent, lateral angles of the incision. Hypopygium yellow; ninth tergite brown, moderately impressed anteriorly, a deep, rounded impression posteriorly and emarginate in the middle of the posterior border; each side of this emargination and from beneath the margin, projects a black, tooth-like process. Outer appendages lanceolate, attenuate outwardly and incurved towards each other.

Holotype: ♂; Plummer's Island, Maryland. July 28, 1912. (W. L. McAtee.)

Paratypes: one male, Hazleton, Pennsylvania, August 20, 1912, (W. G. Dietz) has the lateral abdominal strigae, much more marked; one male, Ridgeway, Ontario, Canada, August 15, 1910, (M. C. Van Duzee), has the antennal flagellum darker, the occipital triangle not apparent, the thoracic stripes ferruginous. A male specimen from Aweme, Manitoba, Canada, (E. Criddle), has the occiput less shining, the triangular spot distinct, but paler. Stigma a shade paler than in the holotype. It is larger—length, 16.5 mm.; wing, 15 mm.

In its shining occiput and unicolorous antennae flagellum, the present species closely approaches *P. sodalis* Loew, but is readily distinguished, by its very slender, pale yellowish-fuscous antennae, the flagellar joints of which are not emarginate beneath, the deeply incised eighth abdominal sternite and very deeply impressed ninth tergite.

**Pachyrhina temeraria** spec. n.

Yellow. Sides of proboscis brown. Antennae entirely yellowish; occiput opaque with shining brown line. Wings with yellowish tint, costal cells yellowish, stigma brown. Abdomen with broad, dorsal stripe and lateral and ventral rows of black strigae.

Female. Length, 17.5 mm.; wing, 13 mm.

Head. Frontal prolongation shining, nasus beset with blackish hairs. Mouthparts and palpi brownish-yellow, basal joint of latter dark brown. Sides of proboscis brown. Face light yellow. Antennae yellowish, scapal joints shining and a shade paler, slender, pubescence fine, whitish, segments with basal verticels of dark setae. Vertex and occiput dark yellow, the latter with a narrow, brown, shining line.

Thorax ivory-yellow, shining; pronotal scutum ferruginous in middle. Praescutal stripes ferruginous, the middle stripe narrowed posteriorly, the lateral stripes not curved outwardly; scutum with curved ferruginous stripe each side. Scutellum and postnotum ferruginous, shining, the latter with large, ivory-yellow patch each side. Transverse suture externally and its continuation in the pleura-dorsal suture to and above the alar insertion, black. Pleura concolorous, shining. Halteres sordid yellow, club fuscous.

Legs yellowish, slender, pubescence coarse, black, femora slightly, tibiae markedly, infuscate at the apex, outer tarsal joints infuscate, metatarsi longer than the tibiae. Wings faintly grayish, with yellowish tint, especially marked along the veins, costal cells markedly tinted yellow; stigma brown; costo-apical portion somewhat infuscate, a spot before and behind the stigma and fork of vein M whitish-hyaline. Rs oblique, short, curved near its base; cell $M^1$ sessile.

Abdomen yellow, base above, paler; a broad, pale brown, dorsal stripe extends from the posterior half of first tergite to end of the seventh; eighth segment entirely blackish, lateral margins of tergum and venter, with a row of black strigae. Ovipositor blackish at base, dorsal valves long and slender, obtusely pointed at the apex, ventral valves a little wider and scarcely more than one-half as long as the former.

Holotype: ♀; Floodwood, Schoolcraft County, Michigan. July 1915. (J. S. Rodgers.)

In its entirely pale yellowish antennae, this species is differentiated from all others. Its nearest ally is *P. perfida,* but the antennal flagellum of the latter is more yellowish-fuscous and lacks the occipital line; in coloration of wing, they resemble each other, but cell $M^1$ in *P. perfida* is long petioled. Aside from antennal characters, *P. temeraria* is distinguished from *P. ferruginea, interpunctata* and *occidentalis,* by the narrow, occipital line.

**Pachyrhina sodalis nictans** subsp. n.

Differs from *P. sodalis* Loew as follows:

Head deep ferruginous; mouthparts and palpi dark yellow. Frontal prolongation and nasus shining, beset with long, black hairs. Antennae robust, scapal joints dark ferruginous, first flagellar joint yellowish-fuscous, remainder of flagellum dark brown; joints, except the outer ones, more deeply excised below. Face opaque, occiput with broad, shining triangle, projected anteriorly upon the vertex.

Thoracic dorsum dark, testaceous, almost pellucid, stripes indistinctly defined. Postnotum sordid yellow on the sides. Pleura sordid yellow, with moderate whitish sheen. Halteres yellowish-brown, club brown. Legs long, slender, yellowish; pubescence very short, blackish, tibiae slightly infuscate at the apex, shorter than the metatarsi; outer tarsal joints infuscate. Wings as in *sodalis*. Abdomen dark orange-yellow, an ill-defined, brownish dorsal stripe, eighth tergite darker, reddish-brown; a lateral row of black strigae and a ventral row of similar spots. Eighth sternite reddish-brown, not emarginate. Hypopygium ferruginous; ninth tergite reddish-brown, very short, deeply and narrowly emarginate in the middle; outer appendages dark yellow, not markedly attenuated towards the apex.

Length, 17 mm.; wing, 13.5 mm.

Holotype: ♂; Bear Creek, Colorado. June 29, 1914. (E. J. Oslar.)

The unique specimen in my possession is defective. In its unicolorous, blackish antennal flagellum and shining occiput it is closely allied to *P. sodalis* Loew, but its general dark ferruginous color, the stouter, more deeply excised flagellar segments and the highly polished thoracic dorsum, with its ill-defined stripes, give it a distinctive appearance. In its dark ferruginous appearance it resembles *P. cingulata*; but is readily distinguished by its unicolorous flagellum, the wings without yellow tint and the abdominal tergites without latero-posterior black margins.

**Pachyrhina costomarginata** spec. n. (Pl. V, fig. 13.)

Yellow. Occiput opaque, with shining, triangular spot. Antennae, with the exception of the three basal joints, dark brown. Thoracic stripes shining, interspaces opaque. Wings slightly infuscate, costal cells brown, stigma pale fuscous.

Male. Length, 9.5 mm.; wing, 8 mm.

Head deep yellow. Frontal prolongation with obscure, ferruginous, median stripe, nasus beset with black hairs, mouthparts and palpi dull yellow, first joint infuscate at apex. Antennae of moderate thickness, pubescence dense, whitish; three basal joints yellow; joints four and five dark yellowish-brown, following joints dark brown, segments cylindroidal, basal enlargement marked with a whorl of few, rather short, black setae. Face pale yellow; frontal

tuberosity marked; a narrowly triangular, shining, occipital spot, scarcely darker than the surrounding color, an obscure dark line extends from the anterior end of the occipital spot to summit of the frontal tuberosity.

Thorax concolorous, dorsum, except the stripes, opaque, the latter highly polished, yellowish-red, the middle stripe narrowed posteriorly, narrowly margined ferruginous, a fuscous spot at the posterior end; lateral stripes rather wide, curved outward anteriorly, narrowly margined ferruginous on inner margin. Scutum with the exception of middle stripe shining, the latter with a fuscous spot at its base; a diffused yellowish-red stripe each side. Scutellum ferruginous, polished. Postnotum yellowish-red along the middle, shining, sides yellow, outer part of transverse suture and posterior end of pleuro-dorsal suture, black. Pleura light yellow, shining. Halteres sordid yellow, basal half of club brown, apical part yellowish-white. Legs slender, yellowish; femora and tibiae infuscate at the apex, the latter about as long as the metatarsi, tarsal joints fuscous; pubescence very short, sparse, blackish. Wings slightly fuscous, costal cells brown, stigma very pale fuscous; veins brown, vein C and Sc almost black. Cell $M^1$ sessile. Veins C, Sc, R and its branches and veins $M^{1,2 \text{ and } 3}$ setulose. Venation as in figure.

Abdomen yellow, tergum with a pale fuscous spot each side of base, sternites two to five, each with a large, fuscous spot; eighth sternite rounded at the apex and fringed with long, yellow, silken hair. Hypopygium yellow; ninth tergite a little wider than long, longitudinally impressed in front, narrowly emarginate in the middle of the posterior margin, sides rounded; outer appendages paler, lanceolate.

Holotype: ♂; Bradentown, Florida. March. (M. C. Van Duzee.)

In its fuscous flagellum, shining occipital spot and the outer part of the transverse suture tinted black, this species is allied to *P. ferruginea, occidentalis* and *beutenmuelleri*, from all of which it differs in the brown costal cells of the wing. In the single specimen before me, vein $R^{4 \text{ and } 5}$ is peculiarly curved.

**Pachyrhina beutenmuelleri** spec. n. (Pl. V, fig. 14.)

Similar to *ferruginea* Fabricius. Flagellum unicolorous, blackish. A brown spot each side of vertex. Latero-posterior margins of abdominal segments black. The inner appendages of the hypopygium end in a style-like process.

Male. Length, 10.5 mm.; wing, 10.5 mm.

Head. Frontal prolongation shining, nasus long, beset with black hairs. Proboscis very short; mouthparts dark brown; basal joint of palpi dark yellow, brown at apex, following joints yellowish-fuscous. Face pale yellow. Antennae moderately long, the three basal joints reddish-yellow, the third joint infuscate apically, the rest of flagellum blackish, pubescence very fine, white; segments cylindroidal, enlarged at base with a whorl of but three or four black setae. Front and occiput opaque, orange-yellow, tuberosity promi-

nent, a dark brown spot each side of vertex, close to the orbit; a shining, ferruginous, elongate-triangular occipital spot, prolonged as a fine, brown line to summit of tuberosity.

Thorax yellow. Pronotal scutum brown on the sides. Praescutal stripes highly polished, ferruginous, the middle stripe narrowed posteriorly, the lateral stripes slightly curved outward anteriorly. Scutum with lateral, curved, ferruginous stripes, an elongate, brown spot on the anterior end of the median space. Scutellum ferruginous, shining. Postnotum ferruginous along middle portion and posterior declivity, yellow on the sides. Outer portion of transverse suture and a triangular spot before the alar insertion, blackish. Pleura concolorous, lower part of mesopleura, posterior margin of metapleura and a few irregular, smaller spots, ferruginous; a conspicuous, elongate, opaque spot in the pleuro-dorsal membrane immediately behind the middle, a less conspicuous, brown spot below it. Halteres pale fuscous, club dark brown, apical edge paler. Legs slender, sordid yellow, pubescence blackish, tibiae blackish at the apex, about as long as the metatarsi, outer tarsal joints fuscous. Wings nearly hyaline with a grayish tint, surface sparsely pilose, veins C, Sc, R and all veins beyond the cord, with the exception of those limiting cell 1st $M^2$, rather closely setulose; costal cells concolorous, stigma pale brown; cell $M^1$ sessile. Venation as in figure.

Abdomen orange-yellow, shining, darker posteriorly, segments on the sides and posteriorly, bordered with black; the eighth sternite narrowly but deeply emarginate. Hypopygium ferruginous-brown; ninth tergite with deep, V-shaped emargination; outer appendages pale yellow, broadly lanceolate, obtusely pointed; the inner appendages end in a style-like process, directed dorsad.

Holotype: ♂; Black Mountains, North Carolina.

Paratype: ♂; topotypic. September 4, 1911. (Wm. Beutenmueller.)

Might readily be taken for *P. ferruginea*, but the fuscous spots on vertex, the abdominal segments bordered with black on the sides and posteriorly and the formation of the inner appendages, easily distinguish it from the last named species. In general appearance, *P. beutenmuelleri* resembles *cingulata*, but this species has the flagellar segments bicolored, the costal cells yellow-tinted, besides other differences. Dedicated to Mr. Wm. Beutenmueller.

**Pachyrhina cingulata** spec. n. (Pl. V, fig. 17; Pl. VII, fig. 30.)

Antennae of male long, flagellar joints bicolored, fuscous at base. Thoracic dorsum highly polished, testaceous, stripes ill-defined. Lateral margin of abdominal tergum, and segments posteriorly, bordered black.

Male. Length, 13 mm.; wing, 11 mm.

Head dark ferruginous. Mouthparts and palpi dark brown, terminal joint of the latter a trifle longer than the three preceding joints combined. Frontal prolongation polished, beset with blackish hairs, more dense upon the nasus.

Face and front opaque, the latter with a darker median spot. Antennae elongate, joints one to four dark yellow, following joints dark yellow, fuscous at base, flagellar joints two to six or seven, deeply emarginate beneath, outer joints nearly cylindroidal; pubescence fine, dense; the basal setae confined almost entirely to the dorsal side. Occiput shining, acutely produced anteriorly. A large black spot each side of base of neck.

Thorax. Pronotal scutum and scutellum dark ocherous, opaque. Dorsum highly polished, testaceous; praescutal stripes ill-defined, those of the scutum distinct, consisting each of a large, dark ferruginous, antero-exterior spot and a somewhat paler, postero-interior stripe. Scutellum and postnotum yellowish. Pleura yellowish, shining, with some scattered, ocherous spots and patches. Halteres yellowish-brown, paler at base, club fuscous at the apex. Legs dull yellow, very slender, densely beset with rather coarse, short hair, the three outer tarsal joints fuscous, metafarsi much longer than the tibiae. Wings strongly tinted yellow, costal cells and margin of vein Cu and $Cu^1$ more markedly yellow, stigma pale brown; costo-apical region somewhat infuscated; veins C, Sc, and R and its branches, shortly and rather closely setulose; veins $M^{1, 2 \text{ and } 3}$ more sparsely setulose, and setulae rather long and fine. Venation as in figure.

Abdomen testaceous, lustrous; first tergite with black median stripe, a more or less interrupted lateral stripe and posterior margin of segments black, paler and interrupted on some segments. Venter with a row of black spots. Eighth sternite with rounded emargination, the latter fringed with yellow hair. Ninth tergite light brown, rounded latero-posteriorly with a large, deep, semicircular impression anteriorly, giving the appearance as though the tergite consisted of two incurved processes, leaving a narrow space between the latter, apically. Outer appendages of hypopygium brownish, basal half lanceolate, apical half very slender, curved ventrad, the inner (?) appendages consist of a pair of blackish, strongly chitinized processes, projecting posteriorly, turned up angularly at the end and ending in an acute spine; an acutely, triangular tooth externally and a spine within near the base; ninth sternite brown, long, with wide median fissure containing a pale yellowish body, pleural suture faint, slightly curved but not curved dorsad anteriorly.

Female. Length, 16 mm.; wing, 13 mm.

Very similar to the male. Antennae relatively short, joints one to five or six fairly stout, following joints very slender, verticels complete. Stripes of mesonotal scutum less distinct. The lateral stripe of the abdomen and the posterior margin of the segments, completely and conspicuously banded with black; the first tergite without median stripe, posterior segments more extensively black. Ovipositor dark ferruginous, dorsal valves long and slender, slightly curved downward at the apex; ventral valves slender, three-fourths the length of the upper valves, pointed.

Holotype: ♂; Hazleton, Pennsylvania. July 11, 1913. (W. G. Dietz.)

Allotype: ♀; topotypic. August 18, 1915.

Paratypes: nine females, topotypic, June, July, August.

A very distinct species. Closely allied to *P. xanthostigma*, with which it agrees in the antennal structure, the shining occiput and coloration of wings, and from which it is readily distinguished in its dark testaceous or ferruginous color, the abdominal segments conspicuously—especially in the female—banded with black and the very differently constructed hypopygium.

All the specimens were taken in a rather circumscribed marshy locality, where rarely more than one or two specimens were taken in a season.

**Pachyrhina obliterata** spec. n. (Pl. V, fig. 15; pl. VII, fig. 31.)

Yellow. Flagellar joints of antennae bicolorous, blackish at base. Occiput shining. Thoracic stripes ferruginous, the transverse suture black externally. Abdomen with dorsal stripe and lateral rows of spots, dark fuscous.

Male. Length, 14 mm.; wing, 12.5 mm.

Head concolorous. Proboscis very short, sides fuscous; frontal prolongation with two ferrûginous lines, beset with dark hairs, more dense on the nasus. Mouthparts brown. Palpi yellowish-brown, the last joint shorter than the three preceding joints. Face pale yellow and like the front, opaque. Antennae of moderate length and thickness, the three basal joints dark yellow, the following joints dusky yellow and, with the exception of the apical joints, distinctly emarginate beneath, above the basal enlargement, the latter blackish, hairs of the verticel blackish and rather long; pubescence fine, whitish. Occiput shining, extending triangularly upon the vertex.

Thorax shining, sulphur yellow. Pronotal scutum and scutellum tinted with fuscous, the former with a pale line each side. Dorsal stripes ferruginous, the middle stripe narrowed posteriorly, lateral stripes curved outward anteriorly; the interspaces between the middle and lateral stripes, margined black on their anterior margins. Scutum with a broad stripe each side, which leaves but a narrow margin of the ground color externally and a nearly parallel, median stripe. Scutellum and broad median stripe of postnotum ferruginous. Transverse suture heavily black in middle section, less so on its exterior ends, again very conspicuously so in the pleuro-dorsal suture before the alar insertion. Pleura concolorous, sternopleura inferiorly, and a few small, inconspicuous spots, ocherous. Halteres dark yellow, club brown, apex paler. Legs slender, dark yellowish covered with a dense, grayish pubescence, femora and tibiae lightly infuscate towards the apex, outer joints of tarsi fuscous, metatarsi longer than the tibiae. Wings with a grayish tint, dispersedly pubescent; costal veins, vein R and the veins beyond the cord with the exception of those limiting cell 1st $M^2$ setulose; costal cells and margin of vein Cu, pale yellow; stigma yellowish with a fuscous tint, apical part lightly infuscate.

Abdomen yellow with light fuscous touch, a dark brown dorsal stripe, paler posteriorly and more or less interrupted, extends from the base to the sixth tergite, the seventh tergite apically and the eighth nearly entirely, blackish; a lateral row of large, elongate black spots, alternating with fine black strigae;

sternites one to four, with an ill-defined, fuscous spot, eighth sternite feebly emarginate. Hypopygium yellowish-ferruginous, the ninth tergite short, rounded on the sides, deeply impressed and emarginate in the middle posteriorly, outer appendages lanceolate, directed dorsad, inner appendages, strongly chitinized, curved upward and fringed with yellowish hairs.

Female. Length, 17 mm.; wing, 15.5 mm.

Very similar to the male. Antennae shorter. The anterior margin of the interspaces between the middle and the lateral thoracic stripes, is pale brown; the black coloration of the transverse suture much less in evidence; scutellum and postnotum pale yellow. Metatarsi much longer than the tibiae. Abdominal markings less defined, the ninth tergite, except apically, blackish. Ovipositor ferruginous—valves broken.

Holotype: ♂; Wyalusing, Bradford County, Pennsylvania. August 3, 1916. (W. G. Dietz.)

Allotype: ♀; topotypic.

Paratypes: two males, topotypic, one male, Floodwood, Schoolcraft County, Michigan, July, 1915, (J. S. Rogers); one female, Ottawa, Canada, July 26, 1912, (Germain Beaulieu).

A rather isolated form. Its nearest ally is *P. xanthostigma* Loew, from which it is readily differentiated, by its shorter and more dusky antennae. The wings are hyaline and pubescent with a grayish tint, while the abdomen is dusky yellow with a distinct dorsal stripe. The allotype, has cell $M^1$ sessile in one wing, short-stemmed in the other. The paratype from Michigan, has this cell long-stemmed in both wings. The paratype from Canada, has a reddish-brown occipital line.

**Pachyrhina wyalusingensis** spec. n. (Pl. V, fig. 16; pl. VII, fig. 32.)

Similar to *P. obliterata*. Head dark testaceous. Flagellar joints bicolored, blackish at base. Occiput shining. Thoracic stripes dark ferruginous. Abdomen dark testaceous, lateral margins of tergum and posterior margins of segments, bordered black.

Male. Length, 14 mm.; wing, 12.5 mm.

Head. Mouthparts fuscous. Palpi dark ferruginous. Frontal prolongation with two dark lines. Three basal joints of antennae reddish-yellow, following joints yellowish-fuscous, basal enlargment blackish; pubescence dense, whitish; segments emarginate beneath. Front opaque with a fuscous dot close to the orbital margin. Occiput shining, with a small fuscous spot at its base.

Thorax shining, yellow. Pronotal scutum and scutellum tinged with fuscous. Praescutal stripes as in *obliterata*, the lateral stripes not curved outwardly, scutum, scutellum, postnotum and pleura as in *obliterata*, the transverse suture less markedly black in middle portion. Halteres yellowish-fuscous, club dark fuscous. Legs long and slender, dusky yellowish, femora and

tibiae infuscate at the apex, outer tarsal joints dark brown. Wings with a pale fuscous tinge, costal cells yellowish, stigma yellowish with scarcely perceptible fuscous tinge, surface finely and very sparsely pilose, veins C, Sc, R and its branches and veins $M^{1,2 \text{ and } 3}$ setulose. Venation as in figure.

Abdomen testaceous, shining. A black, conspicuous, lateral stripe and segments banded with fuscous on the posterior margin, less marked on the posterior segments. Eighth segment brown. Venter paler with some ill-defined, brownish spots, eighth sternite scarcely emarginate. Hypopygium dark ferruginous; the ninth tergite slightly impressed anteriorly, more broadly and deeply posteriorly, with a narrow and deep incision in the posterior margin, outer appendages narrow, incurved; inner appendages relatively short, stout, somewhat compressed, directed dorsad; ninth sternite deeply incised, the incision fringed with golden-yellow hair.

Female. Length, 18 mm.; wing, 14 mm.

Similar to male. Antennae shorter and more slender. The fuscous spot at base of occiput faintly indicated. Thoracic dorsum almost pellucid, the middle stripe wider anteriorly. Intercoxal portion of sternopleura and greater part of mesopleura ocherous. Lateral margin of abdominal tergum and posterior margin of all the segments, conspicuously bordered black; eighth segment brown. Ovipositor brown, dorsal valves moderately long, ferruginous towards the tip, ventral valves extend a little beyond the middle of the upper valves, pale, acute.

Holotype: ♂; Wyalusing, Bradford County, Pennsylvania. August 3, 1916. (W. G. Dietz.)

Allotype: ♀; topotypic.

**Pachyrhina latevittata** spec. n. (Pl. V, fig. 18.)

Pale yellow; head ferruginous. Flagellar joints of antennae bicolored, dark fuscous at base. Occiput with shining spot. Thoracic stripes pale tan color, broad. Wings hyaline, stigma almost so. Abdominal tergites two to five with two, pale brown, dorsal lines.

Female. Length, 16 mm.; wing, 15 mm.

Frontal prolongation dark yellowish, shining, subcarinate with median dark line, hairy vestiture black, dense on nasus. Mouthparts large, and like the palpi, sordid yellow. Proboscis very short. Face and occiput opaque, the latter with a broadly subtriangular, shining spot, frontal tuberosity strongly marked. Antennae short, scapal joints ferruginous, flagellar joints dark, sordid yellow, fuscous at base, with verticels of rather short, black setae.

Thorax concolorous with feeble luster. Pronotal scutum brown on the sides. Praescutal and scutal stripes a pale tan, the former finely and interruptedly margined with brown, the middle stripe very little narrowed posteriorly. Scutellum and postnotum with a little more luster, the former light ferruginous, the latter yellowish on the sides, ferruginous along the middle. Transverse suture, except its middle third, and its continuation before the alar insertion, black. Pleura concolorous, with a white sheen, a broad, irregu-

lar whitish stripe extends from the upper part of the sternopleura to the metapleura and margin of the postnotum. Halteres dark yellowish at base, brownish towards and including the club. Legs very slender, pale yellowish, metatarsi pale fuscous, rest of tarsi darker; pubescence very short, black; tibiae a little longer than the metatarsi. Wings entirely hyaline, stigma with faint tinge of brownish. Cell $M^1$ rather broadly sessile. Veins C, Sc and R, $M^{1, 2 \text{ and } 3}$ very finely setulose. Pl. V, fig. 18.

Abdomen yellow. Tergite two with a brown spot anteriorly, posteriorly similar to tergites three and four with two, brownish, dorsal lines, tergites five to eight, tinged with pale brown; venter a shade paler. Ovipositor yellow, dorsal valves, long and narrow, ventral valves rather short, lanceolate, pointed.

Holotype: ♀; South Park, Colorado. June 17, 1916. (E. J. Oslar.)

An isolated form. The dark ferruginous head is in strange contrast to the general yellow color. From its nearest allies, *P. suturalis* Loew and *abbreviata* Loew, it is distinguished by the entirely hyaline wings and almost colorless stigma.

**Pachyrhina approximata** spec. n. (Pl. V, fig. 19; pl. VII, fig. 33.)

Antennae of male long, flagellar joints fuscous, ferruginous at base—except outer joints. Occiput shining with brown stripe. Thoracic stripes ferruginous-brown. Abdomen with black lateral stripes, segments margined with fuscous posteriorly.

Male. Length, 12 mm.; wing, 12 mm.

Frontal prolongation dark yellow, shining, with two, brown, dorsal lines and beset with black hairs; sides of proboscis brown at base; mouthparts and palpi yellowish-brown, first palpal joint yellow at base. Face yellow with a brown, triangular spot. Antennae slender, extended back they reach beyond the base of the abdomen; scapal joints light ferruginous, flagellar joints brown, joints two to seven ferruginous at base, emarginate beneath, verticels incomplete, setae shorter than the respective joints; pubescence dense, whitish. Occiput ferruginous, shining with dark brown, median stripe. Neck brown.

Thorax shining above, yellow. Pronotal scutum and scutellum opaque, the the former brownish in the middle and a spot on the sides. Praescutal stripes dark brown anteriorly, ferruginous posteriorly, the middle stripe strongly narrowed posteriorly. Scutum sulphur yellow with a ferruginous stripe each side and a similar spot within the alar insertion. Scutellum ferruginous. Postnotum sulphur yellow, with median line and posterior declivity light ferruginous. Pleura sulphur yellow; intercoxal part of sternopleura, lower half of mesopleura, and metapleura posteriorly, ocherous-ferruginous. Middle portion of transverse suture tinted blackish. Legs long and slender, yellowish-brown, femora and tibiae infuscate apically, tarsi fuscous, metatarsi markedly longer than the tibiae, pubescence dense, coarse, blackish. Halteres brownish-yellow, apical half of club dark brown. Wings grayish, costal cells and margin of vein Cu and $Cu^1$ tinted yellow, stigma yellowish with faint brownish tint; cell $M^1$ sessile. Costal veins, vein R and veins $M^{1, 2 \text{ and } 3}$ setulose. Venation as in figure.

Abdomen testaceous, an obscure, interrupted dorsal line, broad and conspicuous black lateral stripe and posterior margin of segments, dark brown; eighth segment entirely blackish-brown, sternite with deep V-shaped incision enclosing a paler, median appendage. Hypopygium, except the ninth tergite, yellowish; the latter brown, rounded latero-posteriorly, lightly impressed in front and behind and slightly emarginate in the middle, outer appendages elongate—lanceolate, anticlinal; ninth sternite deeply emarginate, each side anteriorly with a strongly curved, claw-like process, directed dorsad. Pl. VII, fig. 33. Pleural suture straight, abbreviated.

Female. Length, 19 mm.; wing, 13.5 mm.

Similar to the male. Head orange-yellow. Antennae short, flagellar segments slightly emarginate beneath, setae of verticels shorter than the respective joints. The thoracic stripes are less infuscated anteriorly and the pleural markings paler; the dark spot on the metapleura is absent. Dorsal stripe of abdomen, blackish and uninterrupted; the lateral stripes and the black margins of the segments, here and there interrupted. Ovipositor ferruginous; dorsal valves very narrow, not very long; the ventral valves broader and nearly the length of the upper valves.

Holotype: ♂; Wyalusing, Bradford County, Pennsylvania. August 2, 1916. (W. G. Dietz.)

Allotype: ♀; topotypic.

Paratypes: four females, topotypic.

Closely resembles *P. cingulata*, but differs in the flagellar joints being dark brown at base. Thoracic stripes distinct and the wings more grayish. From *P. brevicornis* Loew, it differs in the abdominal markings.

**Pachyrhina stigmatica** spec. n. (Pl. V, fig. 20; pl. VII, fig. 34.)

Honey-yellow. Antennae—male—short, flagellar joints, except the first, bicolored, yellow at base. Thoracic stripes dark-ferruginous. Stigma dark brown. Abdomen with dorsal stripe and lateral and ventral rows, of black spots; eighth sternite produced, not emarginate.

Male. Length, 14 mm.; wing, 12.5 mm.

Head concolorous; frontal prolongation shining, darker anteriorly, the hairy vestiture rather long, dark, nasus long, infuscate. Mouthparts and basal joint of palpi brown, remaining palpal joints brownish-yellow, the last joint a little longer than the others combined. Sides of proboscis brownish. Face and scapal joints of antennae pale yellow, flagellar joints slender, cylindroidal, brown, yellow at base; verticels complete, setae long; pubescence whitish. Occiput shining, somewhat tinged with fuscous on the sides and an ill-defined brownish spot each side near the orbital margin.

Thorax concolorous, shining. Pronotal scutum broadly brownish in middle portion, which is continued as a stripe upon the neck to base of occiput. The middle thoracic stripe narrowed posteriorly and divided by a pale line, lateral

stripes rather narrow and short, straight. Scutum with a subangulate stripe each side, leaving a pale, parallel median space; extreme outer end of transverse suture and spot before alar insertion, black. Scutellum and postnotum concolorous. Pleura with a few indistinct, darker spots and a whitish sheen. Halteres sordid yellowish, club pale fuscous, apex dark brown. Legs long, slender, yellowish, pubescence coarse, black; femora and tibiae lightly infuscate at the apex, outer tarsal joints fuscous, the metatarsi a little longer than the tibiae. Wings hyaline with yellowish tint, costal cells and border of vein Cu and $Cu^1$ yellowish. Stigma pale brown, costal region beyond the stigma, lightly infuscate. Veins $M^{1,2 \text{ and } 3}$ and $Cu^1$ distinctly setulose. Venation as in figure.

Abdomen concolorous. A brown dorsal stripe extends from base to seventh tergite, less defined and paler posteriorly; lateral margin of tergum with a row of black spots, large and semi-ovoidal on tergites two to five; venter pale yellowish, each sternite with a small, elongate, black dot; eighth segment, with the exception of apical half of sternite, dark brown, the sternite produced, scarcely emarginate, fringed with long hairs, which form a sort of curved pencil at each apical angle. Hypopygium, except the ninth tergite, yellowish, the latter dark brown, somewhat swollen, rounded latero-posteriorly, deeply impressed in front and behind, emarginate in the middle; from below the margin project two very slender processes; outer appendages lanceolate, attenuated and curved downward; the inner appendages claw-like, curved down and inward; ninth sternite deeply emarginate; from the anterior part projects an upcurved, claw-like process.

Holotype: ♂; Wyalusing, Bradford County, Pennsylvania. August 4, 1916. (W. G. Dietz.)

Paratype: ♂; topotypic.

Closely allied to and easily confounded with *P. brevicornis* Doane, from which it differs in the protuberant and scarcely emarginate eighth sternite of the male, and different construction of the hypopygium. The paratypic specimen, has the lateral row of abdominal spots coalescent, thus forming an uninterrupted lateral stripe.

## EXPLANATION OF PLATES

### Plate IV

Fig. 1.—Wing of *P. ostari.*
Fig. 2.—Wing of *P. macrophallus.*
Fig. 3.—Wing of *P. puncticollis.*
Fig. 4.—Wing of *P. hirsutula.*
Fig. 5.—Wing of *P. urocera.*
Fig. 6.—Wing of *P. cornifera.*
Fig. 7.—Wing of *P. calinota.*
Fig. 8.—Wing of *P. montana.*
Fig. 9.—Wing of *P. opacivittata.*
Fig. 10.—Wing of *P. evasa.*
Fig. 11.—Wing of *P. nexilis.*

### Plate V

Fig. 12.—Wing of *P. festina.*
Fig. 13.—Wing of *P. costomarginata.*
Fig. 14.—Wing of *P. beutenmuelleri.*
Fig. 15.—Wing of *P. obliterata.*
Fig. 16.—Wing of *P. wyalusingensis.*
Fig. 17.—Wing of *P. cingulata.*
Fig. 18.—Wing of *P. latevittata.*
Fig. 19.—Wing of *P. approximata.*
Fig. 20.—Wing of *P. stigmatica.*
Fig. 21.—Hypopygium of *P. ostari;* lateral aspect.
Fig. 22.—Hypopygium of *P. hybrida;* lateral aspect.
Fig. 23.—Hypopygium of *P. okefenoke;* dorsal aspect (from a paratype kindly given me by Mr. C. P. Alexander).

### Plate VI

Fig. 24.—Hypopygium of *P. macrophallus;* lateral aspect.
Fig. 25.—Hypopygium of *P. urocera;* lateral aspect.
Fig. 26.—Hypopygium of *P. cornifera;* dorsal aspect.
Fig. 27.—Hypopygium of *P. tennis;* ventral aspect; 27 A, outer and inner appendages, seen from within; 27 B, anterior end of penis-guard with its geniculate, rod-like processes (Snodgrass).

## Plate VII

Fig. 28.—Hypopygium of *P. tenuis hamata;* lateral aspect, showing the protuberant and strongly geniculate rod-like processes.
Fig. 29.—Hypopygium of *P. nexilis;* lateral aspect.
Fig. 30.—Hypopygium of *P. cingulata;* dorsal aspect.
Fig. 31.—Hypopygium of *P. obliterata;* ventral aspect.
Fig. 32.—Hypopygium of *P. wyalusingensis;* ventral aspect.
Fig. 33.—Hypopygium of *P. approximata,* lateral aspect.
Fig. 34.—Hypopygium of *P. stigmatica;* lateral aspect.

# NEW GENERA AND SPECIES OF MELANOPLI FOUND WITHIN THE UNITED STATES (ORTHOPTERA; ACRIDIDAE)

BY MORGAN HEBARD

In the past few years the Melanopli from North America, north of the Mexican boundary, in the Philadelphia collections have been assembled, sorted to species and given a preliminary examination by the author. In addition, a large part of the historic material bearing on this group, in other American collections, has very kindly been loaned to us for comparison and study. The time for compilation of the manuscript of this study has arrived, the thousands of specimens being fully arranged and their relationships plotted, but active military service obliges the postponement of this work for an indefinite period. It appears advisable, however, to describe the new species, except those of the genus *Melanoplus*, which do not need further study to determine racial values, which species will later be more elaborately treated in the contemplated study.

The sequence of the species here described is according to the revised arrangement of the species from the preliminary studies already completed.[1] The final study of the group will probably show some changes in this order, but we do not believe these will be at all drastic. It is clear that Scudder incorrectly grouped many forms.

Particular efforts have been made in all the field work by Rehn and Hebard to secure as large and representative series of the group as possible. This has shown that, though we are now in a far better position to treat the species with scientific accuracy, it is highly probable that intensive local field work, particularly at high elevations in the mountains of the West, will reveal additional undescribed forms.

In the present paper two new genera, ten new species and one new geographic race are described. The series of these new

[1] The same system of linear arrangement is followed in the author's "Notes on Mexican Melanopli," Proc. Acad. Nat. Sci. Phila., 1917, pp. 251 to 275, (1917).

forms examined contains five hundred and sixty-six specimens, of which all but thirteen are in the Philadelphia collections.

**Gymnoscirtetes morsei**[2] new species (Plate VIII, figs. 4, 5 and 6.)

This species shows close relationship to *G. pusillus* Scudder (Plate VIII, figs. 1, 2 and 3), agreeing in form, coloration and color pattern. The genitalia of both sexes afford, however, striking and constant characters for specific distinction.

*Type.*—♂; De Funiak Springs, Walton County, Florida. August 30, 1915. (Rehn and Hebard.) [Hebard Collection, Type No. 215.]

Size larger than, form similar to, that of *pusillus*. Head with interocular space about as wide as first antennal joint [3] (wider than normal in *pusillus*). Prosternal spine rather elongate, beyond base rather slender, cylindrical, scarcely tapering to the bluntly rounded apex (in this sex of *pusillus*, though individually slightly variable, this spine averages shorter and tapers distinctly to the less bluntly rounded apex). Supra-anal plate elongate shield-shaped, with surface longitudinally trisulcate, the lateral margins moderately reflexed and with two small, elongate, longitudinal convexities proximo-laterad of the small projecting apex (in *pusillus* much shorter, triangular, with lateral margins very feebly convex and apex blunt; contour similar but much less decided). Furcula as in *pusillus*. Cerci specialized, distinctive (see Plate VIII, fig. 5). Subgenital plate strongly elevated in a large, medio-dorsal projection, which is fully twice as long as broad, with apex blunt, directed dorso-cephalad (this is a similar but very much more decided development of the type found in *pusillus*).

*Allotype.*—♀; same data as type. [Hebard Collection.]

Size larger than male, larger than in *pusillus*. Agrees with male in ambisexual characters, except that the interocular space averages broader, the prosternal spine is heavier and shorter (this spine in females of *pusillus* shows the same relative difference, but not as conspicuously, as in the male sex of these species, in all exhibiting slight individual variation). Ovipositor valves elongate; the dorsal pair with disto-dorsal declivity brief to the blunted apical tooth (in *pusillus* the disto-dorsal declivity is much more elongate, with apical tooth acute); the ventral pair with disto-lateral and apical tooth blunted, the portion beyond the disto-lateral tooth very brief (in *pusillus* with these teeth acute, the portion beyond the disto-lateral tooth elongate).

[2] In honor of Dr. Albert P. Morse, of Wellesley, Massachusetts, whose splendid studies in North American Orthoptera may be said to include among the first publications dealing with the subject in a thoroughly scientific manner.

[3] In the series at hand, however, this dimension shows some variation; it may be said to average wider in *morsei* than in *pusillus*.

*Measurements (in millimeters)*

| ♂ | Length of body | Length of antenna | Length of pronotum | Width of pronotum | Length of caudal femur |
|---|---|---|---|---|---|
| *Type.* | 15.3 | 6.1 | 2.5 | 2.2 | 7.9 |
| *Paratypes* (16). | 14.2–16.2 | 5.3–6.2 | 2.3–2.6 | 2.1–2.3 | 6.8–7.4 |
| ♀ | | | | | |
| *Allotype.* | 20.7 | 7.2 | 3.1 | 2.8 | 9.4 |
| *Paratypes* (11). | 19.5–21.5 | 6.7–6.5 | 3–3.1 | 2.7–2.8 | 9.7–9.4 |

General coloration of dorsum ochraceous-tawny to clay color. Eyes chestnut brown, with a broad postocular band of shining blackish chestnut-brown extending caudad to distal third of abdomen. All portions below these bands and distal portion of male abdomen paler than dorsum, yellowish, sometimes with a greenish tinge. Caudal femora clay color, in occasional females strongly tinged with absinthe green. Caudal tibiae kildare green to absinthe green, spines white with distal half black. (In all features much as in *pusillus*.)

In addition to the type and allotype, a series of sixteen males and eleven females, all bearing the same data, are considered paratypes. This series was taken in a boggy area of wire-grass and bog plants, which was not over fifteen yards wide by forty yards long. No sign of the species was found elsewhere, even in areas of similar vegetation.

**Phaulotettix eurycercus** new species (Plate VIII, figs. 7 and 8.)

This insect is related to *P. compressus* Scudder. The major features of difference are the smaller size, distinctive cerci, pallium and subgenital plate of the male and the much smaller size and somewhat less robust form of the female. Unlike that species,[4] strongly contrasting green and brown color phases do not appear to be developed in *eurycercus*. In the fifty-nine specimens before us all are brown, one female and a few males being tinged with greenish yellow; none show different types of caudal tibial coloration, the caudal tibiae being pink, individually varying in intensity.

While the distribution of *compressus* is known to extend in Mexico over the greater portion of Coahuila and over Tamaulipas to northern Vera Cruz, the material at hand shows its distribution in the United States to be coincident with, but much more

[4] See Hebard, Proc. Acad. Nat. Sci. Phila., 1917, p. 262, for synonymy and discussion of the striking color variations in *compressus*. It should be noted that the first description of adults of that species is by Rehn, for his synonymous *Sinaloa brevispinis*, Proc. Acad. Nat. Sci. Phila., 1904, p. 535.

restricted than, that of *eurycercus*. The material before us of *compressus* is from Beeville, Cotulla, Sabinal, Uvalde and Del Rio, Texas.

*Type.*—♂; Laguna del Gato, three miles west of Sam Fordyce, Hidalgo County, Texas. Elevation 175 to 200 feet. August 6, 1912. (Rehn and Hebard.) [Hebard Collection, Type No. 218.]

Size smaller than *compressus*, form appreciably less robust, this the more pronounced in head, pronotum and caudal femora. Head and pronotum agreeing in contour with that species, the caudal margin of the pronotum similarly (normally) very feebly concave. Tegmina elliptical, (normally) smaller than in *compressus*, extending almost to caudal margin of metanotum (in series occasionally extending slightly beyond metanotum, as is normal for *compressus*). Prosternal spine blunt conical. Supra-anal plate and minute, linear, parallel furcula much as in *compressus*. Cerci distinctive, broad, tapering moderately in proximal two-thirds, distal third three-fifths as broad as base with margins parallel to transversely truncate apex, the dorsal angle of which is more broadly rounded than the ventral angle (compare Plate VIII, fig. 8 with fig. 9 of *compressus*). Pallium broad (twice as broad as in *compressus*), projecting dorsad, twice as broad as high, the convex dorsal surface forming nearly a semicircle with marginal convexity caudad. Subgenital plate rectangulato-convex, truncate (sub-conical convex in *compressus*).

*Allotype.*—♀; same data as type. [Hebard Collection.]

Agrees with type in ambisexual characters, except the following. Size decidedly larger, form decidedly more robust; but not showing anything like the very great disparity between the sexes in these features found in *compressus*. Median carina of pronotum more distinct and percurrent, the pronotum (as in *compressus*) more inflated. Ovipositor valves as in *compressus*.

*Measurements (in millimeters)*[5]

| ♂ | Length of body | Length of pronotum | Width of pronotum | Exposed length of tegmen | Length of caudal femur |
|---|---|---|---|---|---|
| *Type.* | 17 | 3.7 | 3.3 | 2.2 | 9.6 |
| *Paratypes.* | 16–17.7 | 3.7–3.8 | 3.1–3.4 | 2.2–2.8 | 9–9.8 |
| Quitman Mountains, Texas. | 13.2 | 3.2 | 2.8 | 2.2 | 8.2 |
| Del Rio, Texas. | 18 | 4.1 | 3.8 | 2.7 | 10.3 |
| ♀ | | | | | |
| *Allotype.* | 23 | 5.2 | 5 | 3.2 | 12.7 |
| *Paratypes.* | 21–24.5 | 4.6–5.6 | 4.5–5.4 | 3.1–2.9 | 11.7–12.7 |
| Marathon, Texas. | 27 | 5.8 | 5.7 | 3.4 | 13.4 |

[5] In the present paper the measurements are given for the largest and smallest examples of both sexes in the series, where these are not represented in the extremes given for the typical series.

*Coloration.*—Males. General coloration rather light brown, with a broad postocular band of dark brown on each side extending to the principal sulcus (or in other series to the caudal margin) of the pronotum, this often margined dorsad by a narrow band, which is paler than the general coloration. Abdomen with proximal dorsal segments maculate laterad with dark brown to varying degrees. Caudal femora very light brown, heavily twice banded with blackish brown and with genicular areas often as dark. Caudal tibiae pink.

Five males have the paler portions showing a greenish tinge, this most conspicuous on the limbs; in three of these the paler portions are pale yellowish-green.

The females are usually paler, the general brown coloration more reddish. In all, the postocular band is subobsolete and in only the two or three darkest examples are the dark abdominal markings present. The two dark bands of the caudal femora are distinct, but as pronounced as in the male sex in but four specimens. The caudal tibiae are similar to those of the males, though in the paler examples the pink is more dilute.

*Specimens Examined*: 65; 32 males, 16 females, 9 immature males and 8 immature females.

TEXAS: Kerrville, Mission, Laguna del Gato, Uvalde, Del Rio, Sanderson, Marathon, Kent, Neville Spring in Brewster County, Cañon behind Pulliam Bluff in Chisos Mountains and Quitman Mountains.

The adults, with one exception, were taken from August 5 to September 13, 1912 by Rehn and Hebard.

One male from Mission and a series of nine males and ten females from Laguna del Gato, bearing the same data as the type, may be considered paratypes.

The type series was found occasional on small rounded hills covered with loose gravel and bearing scattered bunches of low bushy plants, in company with a slightly less abundant species of *Rhabdotettix*. The Melanopli were generally distributed through the clumps of plants, the present species found more numerous in a low green rhamnaceous shrub (probably *Condalia obovata*), in which *Dichopetala castanea* Rehn and Hebard was locally abundant. The species was found to be everywhere thamnophilous, and was taken up to an elevation of 5000 feet in the Quitman Mountains of extreme western Texas. It was twice found on a sensitive-leaved acacia, *Acacia berlandieri*, and twice singly on sotol, *Dasylirion* species.

**CHLOROPLUS**[6] new genus

This striking monotypic genus is nearest *Campylacantha*, differing in the proportionately much larger head, larger eyes, shorter antennae, more inflated prozona, more delicate wing venation, less inflated cephalic and median femora, proportionately shorter and more robust caudal femora and longer caudal tarsi. The more inflated prozona, less decided pronotal sulci and more delicate venation of the tegmina give the insect a smoother general facies than any species of *Campylacantha*.

Only in the genus *Phoetaliotes* of the North American forms of the Melanopli is the head found to be similarly of disproportionately large size to that of the body. That genus, however, is clearly in no way closely related to *Chloroplus*.

*Genotype.—Chloroplus cactocaetes* new species.

*Generic Characters.* Head very large, longer than pronotum. Eyes large, longer than genae. Antennae short and delicate, only slightly longer than the depth of the head. Caudal margin of pronotum angulate-produced. Distal portion of male abdomen not enlarged, genitalia simple. Lateral margins of male subgenital plate straight. Prosternal spine conical. Caudal femora short and robust. Caudal tarsi nearly half as long as caudal tibiae.

**Chloroplus cactocaetes**[7] new species (Plate VIII, fig. 10.)

This insect is one of the most delicately colored and beautiful of the North American Melanopli. It is apparently widely separated from any other known form.

*Type.*—♂; Corpus Christi, Nueces County, Texas. July 29, 1912. (Hebard.) [Hebard Collection, Type No. 475.]

Size medium, form medium, slightly less slender than in *Campylacantha lamprotata* Rehn and Hebard. Head large, exceptionally large when compared with body bulk, length appreciably greater than that of pronotum. Vertex much as in *Campylacantha*, slightly produced and bluntly rounded, fastigium slightly broader and more concave than in *C. lamprotata*, frontal costa distinctly wider, widest with lateral margins decided between antennae, surface slightly depressed only at the median ocellus. Eyes very large and prominent, much longer than cheeks. Antennae slender and hardly longer than combined length of head and pronotum. Pronotum with dorsum and dorso-lateral portion of prozona somewhat inflated, smooth, with sulci weak;

[6] From χλωρός = pale green, and ὅπλον = armor.

[7] From κάκτος = cactus, and οἰκητής = inhabitant of.

medio-longitudinal carina weak, particularly in caudal portion of prozona; metazona finely impresso-punctate; caudal margin produced, forming an angle of slightly over 90° with apex rounded. Tegmina reaching to near base of supra-anal plate, venation very delicate. Wings reduced, reaching tegminal apices, incapable of sustained flight. Distal portion of abdomen evenly tapering, showing no enlargement. Furcula represented by two brief convexities, each projecting a distance of half its basal width. Supra-anal plate no longer than basal width, triangular with apex rounded, with a slender transverse carina mesad except at medio-longitudinal sulcus, which is deep in proximal half but obsolete distad. Cercus short, simple, broad at base, tapering to acute apex, length hardly one and one-half times basal width. Subgenital plate conical, produced to the dorso-distal blunt apex. Prosternal spine elongate, acute-conical. Interspace between mesosternal lobes over three times as long as wide. Cephalic and median femora moderately inflated. Caudal femora short, very robust, much more so than in any species of *Campylacantha*. Caudal tibiae with (10–11) spines. Caudal tarsus nearly half as long as caudal tibia.

*Allotype.*— ♀ ; same data as type. [Hebard Collection.]

Agrees closely with male in coloration and relative proportions, except in the following characters. Size larger, form stouter and head even larger proportionately than in male. Vertex proportionately broader. Tegmina and wings extending to near apex of supra-anal plate. Genitalia normal, the ovipositor valves short with apices acute and rather strongly curved. Prosternal spine stouter than in male. Interspace between mesosternal lobes nearly twice as long as broad.

*Measurements (in millimeters)*

| ♂ | Length of body | Length of pronotum | Length of tegmen | Length of caudal femur | Width of caudal femur |
|---|---|---|---|---|---|
| *Type.* | 21.7 | 4.8 | 11 | 11.8 | 3.3 |
| *Paratypes* (7). | 18.5–21.8 | 4.2–5.2 | 10.2–12 | 10.6–12.3 | 3.2–3.8 |
| Double Windmill, Brewster County, Texas. | 16.4 | 3.9 | 9.2 | 9.8 | 2.9 |
| ♀ | | | | | |
| *Allotype.* | 25 | 5.7 | 15 | 12.8 | 4 |
| *Paratypes* (9). | 23–26.2 | 5.7–6.2 | 13.3–14.4 | 13.5–14.3 | 4.2–4.4 |
| Cotulla, Texas. | 28 | 6.4 | 14.3 | 14.8 | 4.4 |

The size variation is shown by the series at hand to have no geographic significance whatever.

*Coloration.*—Little variation in general appearance is shown by the series, though considerable differences in shade are apparent on close examination. The material from Corpus Christi averages slightly darker than the other specimens. Those from San Antonio and Cotulla show the richest coloration.

Eyes buckthorn brown to chestnut brown. Antennae cinnamon-rufous, becoming paler and more yellowish proximad. Face light brownish olive,

individually varying through mignonette green through chamois with a greenish tinge to tawny olive, becoming deeper dorsad and there shading evenly into the occipital color, which is jade green individually varying to buffy olive, always bordered on each side by a narrow suffusion of chamois. Genae same color as face, a postocular band of jade green between this area and the pale lateral margins of the occipital area. Occipital coloration extending caudad on dorsum of pronotum as a very broad band of equal width to principal sulcus, thence expanded to include the entire metazona which, however, in some specimens becomes paler ventro-laterad. Medio-dorsal very broad band of prozona broadly bordered on each side with chamois. Lateral lobes of pronotum with postocular band decidedly broadened, widest in caudal portion of prozona, jade green with sometimes a median fleck of chamois, individually varying to solid ivy green; below this the lateral lobes are chamois, often with ventral portion broadly suffused with the general coloration of the face (light brownish olive or mignonette green) or of the metazona (buffy olive). Tegmina immaculate, individually kildare green to cress green. Exposed remaining lateral portions of thorax green, with ventral portion of meta-epimerum and all but narrow proximal portion of meta-episternum strikingly chamois. Ventral portions and abdomen olivaceous or yellowish, the abdomen always tinged with olivaceous distad. Cephalic and median limbs ochraceous-buff, washed, often heavily, with mikado brown. Caudal femora mikado brown, often with external face narrowly paler along the ventral margin and in proximal and distal portions, dorsal face individually clay color or cinnamon, always showing two delicate, but distinct (though individually variable in extent and intensity) and broad, transverse bands of olive. Caudal tibiae lumiere blue (a rich blue, showing slightly more green than glaucous); spines pale lumiere blue or white, with black tips.

*Specimens Examined:* 35; 17 males, 17 females and 1 immature female.

TEXAS: San Antonio, Cotulla, Robstown, Corpus Christi, Lake Lomalta in Cameron County, and in the Big Bend region, Double Windmill, camp two miles north of Bone Spring and Neville Spring.

One male from Robstown and a series of seven males and nine females from Corpus Christi, bearing the same data as the type, may be considered paratypes. The entire series was taken by Rehn and Hebard between July 29 and August 9, 1912.

This remarkable insect, though showing a fairly wide distribution, was found other than singly but once. It is very local, being almost entirely confined to joint-cactus, *Opuntia* species, of the *Cylindropuntia* group, in which heavily armed plant it lives. It was almost impossible to drive a specimen into the open unless the cactus was trampled down with heavy boots. In these plants the insects were found to be extremely alert and quick to dodge into the more sheltered recesses. When driven into the open they displayed unusual leaping powers, and the males were

seen to increase the distance covered by their great leaps by the use of their reduced wings. Individuals made every effort to reach another joint-cactus when driven out and whenever this was accomplished they hid almost instantly. At Corpus Christi the species was found very locally, but in moderate numbers, in the cactus and surrounding low halophytic vegetation of the extensive sandy flats bordering the bay. At all other localities rare individuals were located always in clumps of joint-cactus in dry sandy areas.

**Paraidemona latifurcula** new species (Plate VIII, fig. 11.)

This insect, which in size averages smallest of the species of the present genus, is readily distinguished in the male sex by the very distinctive type of furcula. Females can be separated from those of *P. fratercula*, here described, only by the prosternal spine which is blunter in *latifurcula*. Both of these species average decidedly smaller than *P. mimica* Scudder, but in the Brownsville region of Texas a decided reduction in size is found to occur frequently in that insect.

In linear arrangement this species should be placed first in the genus, followed by *fratercula*.

*Type*.—♂; Brownsville, Cameron County, Texas. July 31 to August 5, 1912. (Hebard.) [Hebard Collection, Type No. 476.]

In all respects the type agrees with a paratypic male of *mimica*,[8] except in the following features. Size very small (averaging smallest of genus); form moderately robust. Furcula a broad, transverse, briefly projecting plate, about three times as wide as long, with brief lateral margins straight and weakly convergent to the sharply but briefly produced, acute latero-caudal angles, caudal margin straight, transverse, between these. Supra-anal plate with lateral margins moderately convergent in proximal third, its surface showing a transverse ridge at this point; in distal two-thirds triangular, this portion about as long as its basal width, the lateral margins moderately concave and more strongly convergent to the strongly acute-angulate rounded apex, surface of this portion showing a rather sharp medio-longitudinal sulcation. The supra-anal plate is decidedly more narrowly triangularly produced than in any other species of the genus. Cerci simple, slenderly acute conical, hardly two-thirds as long as supra-anal plate. Pallium very large and convexly protuberant, as in *mimica*. Subgenital plate very small, fitting into the deep and regular concavity of all but the proximal portion of the caudal margin of the preceding segment; free dorsal margin of subgenital plate rather

[8] We would note that in all the species of *Paraidemona* the caudal margin of the pronotum is weakly concave, and both tegmina and wings are absent.

strongly obtuse-angulate with apex rounded. Prosternal spine conical with apex decidedly blunt, heavier with apex more blunted than in *mimica*. Interspace between mesosternal lobes hardly twice as long as broad.

*Allotype.*— ♀ ; same data as type. [Hebard Collection.]

Agrees with male except in the following features. Size considerably larger, form much more robust. Ovipositor valves as normal for the genus, with distal teeth of dorsal pair not narrowing as much as is usual in allied genera, and with apex in consequence horizontally more broadly convex (in the present series the valves average proportionately slightly shorter than in the other species). Prosternal spine very heavy, heavier than in male, distinctly widest transversely. Interspace between mesosternal lobes quadrate.[9]

*Measurements (in millimeters)*

| ♂ | Length of body | Length of pronotum | Width of pronotum | Length of caudal femur | Width of caudal femur |
|---|---|---|---|---|---|
| *Type.* | 10.8 | 2.7 | 2.4 | 6.9 | 2.2 |
| *Paratypes* [10] (24). | 10–12.8 | 2.6–3.2 | 2.4–3 | 6.7–8.7 | 2.1–2.8 |
| ♀ | | | | | |
| *Allotype.* | 15.5 | 3.7 | 3.9 | 9.8 | 2.8 |
| *Paratypes* (8). | 15.2–17.8 | 3.2–3.8 | 3.4–4.1 | 9–10.2 | 2.7–3 |

Coloration of male very similar to that of *mimica*, except that the buffy markings margining the dorsum of the pronotum laterad are decidedly narrower than is normal in that species, in a few specimens being obsolete. The males are brown, with pale markings buffy and darker markings dark brown. Minor differences in intensity of color pattern are frequent and occasional recessive specimens have the buffy portions yellowish with a very weak tinge of green.

The females agree with the males in general type of color pattern, which is, however, usually much less strongly defined, the markings margining the dorsum of the pronotum laterad being reduced and confined to the prozona or entirely wanting, and the dorsal surface of the caudal femora shows the two dark transverse bands much less distinctly. Two color phases occur in this sex, one in which the general coloration is brown (warm sepia to mikado brown), the other with head, dorsal portions of thorax and caudal femora olive (yellowish olive to light yellowish olive) and abdomen brown. In all the species of *Paraidemona* the caudal tibiae are glaucous tinged with green (lumiere blue to turquoise green).

[9] This feature is not as valuable to separate females of this species from those of *mimica* (in which this interspace averages much longer than wide) as might be imagined. Individually a decided amount of variation occurs, which has convinced us that, though useful as a secondary diagnostic feature, this character has by no means the value we often find ascribed to it in the literature. In the series of *P. mimica* at hand the interspace between the mesosternal lobes varies from subquadrate to nearly three times as long as wide. We have found similar variation in this feature in species of *Melanoplus*.

[10] The average of the series is nearest the type, the maximum individual is decidedly larger than any of the others.

*Specimens Examined*: 40; 26 males, 11 females, 1 immature male and 2 immature females.

TEXAS: Laguna del Gato in Hidalgo County, Brownsville and Piper Plantation in Cameron County.

In addition to the type and allotype, a series of twenty-four males and eight females bearing the same data are considered paratypes. The material was all taken, with the exception of three pairs, by Rehn and Hebard between July 31 and August 6, 1912. The others were taken at Brownsville April 30, 1895 (a pair in coitu) and May 23, 1913.

The insects were found common about Brownsville, in company with *P. mimica* Scudder, wherever grassy areas occurred, either in the open or in open spaces in the river plain jungle scrub. At the Piper Plantation, *mimica* was found to be much the more abundant species in such situations. The present insect probably enjoys a much wider distribution south of the Rio Grande than in the United States.

**Paraidemona fratercula**[11] new species (Plate VIII, fig. 12.)

1897. *Paraidemona punctata* Scudder (not *Pezotettix punctatus* Stål, 1878), Proc. U. S. Nat. Mus., XX, p. 42. (In part.) [♀, Corpus Christi Bay, Texas.]

This insect is closely related to *P. mimica* Scudder, differing only in the average smaller size, slightly more robust form and in the male furcula and supra-anal plate.

The distribution of this species does not reach as far east, north or west in the United States as that of *mimica*. We would note that, from the material at hand, *mimica* is generally distributed over the entire known range of *fratercula*, everywhere averaging decidedly larger except in the Brownsville region of Texas, where a marked reduction in size is shown by the majority of specimens taken. As a result, we would have been unable to separate females of these species from that region without the large series now available.

*Type*.—♂; Lyford, Cameron County, Texas. August 6 and 7, 1912. (Rehn and Hebard.) [Hebard Collection, Type No. 477.]

[11] In allusion to the fact that this species is a diminutive form, showing close relationship to *P. mimica* Scudder.

Agrees fully with a paratype of *mimica* before us except in the following features. Size small, (averaging) decidedly smaller than *mimica*, but appreciably larger than *P. latifurcula*, here described. Form moderately robust.[12] Interspace between mesosternal lobes subquadrate.[13] Furcula represented by twin, slightly swollen adjacent processes, which project beyond the margin of the segment less than (rarely in the series varying to fully) half the basal width of one of these. Supra-anal plate with lateral margins feebly convergent and rather strongly convex in proximal two-thirds and elevated, plate there decidedly (rarely in the series weakly) constricted, the distal third consequently small, triangular with lateral margins convergent and feebly convex to the acute apex, bearing in this portion a medio-longitudinal sulcus. Cerci simple, slender, acute conical, about two-thirds as long as supra-anal plate. Caudal margin of pronotum, pallium, subgenital plate and prosternal spine as in *mimica*.

*Allotype.*—♀; same data as type. [Hebard Collection.]

Similar in every way to females of *mimica* except for the (average) decidedly smaller size and (average) slightly more robust form, which causes the caudal femora to be shorter and slightly heavier. Prosternal spine moderately heavy with apex rather sharply rounded (in the series the apex is seen to vary somewhat in form and when more nearly acute is often slightly flexed cephalad). Interspace between the mesosternal lobes slightly longer than broad (varying in the series to distinctly longer than broad).

*Measurements (in millimeters)*

| ♂ | Length of body | Length of pronotum | Width of pronotum | Length of caudal femur | Width of caudal femur |
|---|---|---|---|---|---|
| *Type.* | 12 | 2.8 | 2.7 | 7.7 | 2.4 |
| *Paratypes* (18). | 10.7–13.8 | 2.7–3.2 | 2.4–2.9 | 7.3–8.3 | 2.2–2.6 |
| ♀ | | | | | |
| *Allotype.* | 17.1 | 3.7 | 3.9 | 10 | 2.8 |
| *Paratypes* (28). | 15.6–19 | 3.3–3.9 | 3.6–4.1 | 9.2–10.4 | 2.8–3 |

The variation shown by the Lyford series is not exceeded in any of the additional material at hand.

*Coloration.*—No noteworthy differences from *mimica* are apparent in coloration. As in that species, two color forms, green and brown, occur; in the present series in about equal numbers, while in the Laredo series a condition about intermediate, pale yellowish with a green tinge, is found. The intensification and recession of the color pattern is shown by the series to be considerable. Nearly all the brown females and a number of the green phase have the color pattern fully as marked as in the male sex, in this feature apparently differing from the usual condition found in *latifurcula*.

[12] When the series at hand are placed beside each other, those of the present species appear slightly more robust than those of *mimica* and slightly less robust than those of *latifurcula*. The difference is, however, not sufficient to be of any value for individual comparisons.

[13] This feature varies in the present species. See page 150, footnote 9.

*Specimens Examined:* 112; 49 males, 61 females and 2 immature males. TEXAS: Beeville, Corpus Christi, Katherine, Lyford, Laguna del Gato in Hidalgo County, Piper Plantation in Cameron County, Lake Lomalta in Cameron County, Point Isabel, Benavides, Carrizo Springs, Cotulla and Laredo.

A series of eighteen males and twenty-eight females from Lyford, bearing the same data as the type, are here designated as paratypes. All but eight specimens of *fratercula* were taken by Rehn and Hebard, between July 28 and August 14, 1912. Two females at hand, from Corpus Christi Bay, were taken in December.

The species was found generally distributed in grassy areas, where at Lyford it was present in very large numbers. Its distribution in the United States is seen to be much wider than that of *latifurcula*, but by no means as extensive as that of *mimica*. The fourth species of the genus, *punctata* (Stål), shows the highest specialization of the male genitalia and is known to us only from Dallas, Texas.[14]

**Eotettix davisi**[15] new species (Plate VIII, fig. 13.)

The two species of this genus here described differ widely from the three previously known species, in their brown general coloration and male cerci, which are in each differently specialized, not simple and acute conical. Their general coloration never shows greenish yellow or green in the adult and, though somewhat shining, has in life none of the pearly and distinctive luster which in the field so strikingly distinguishes the other species.

Both *davisi* and *quercicola*, here described, agree closely in general; the characters for separating them are given under the latter species. In general appearance these insects suggest rather strongly a very large and exceedingly smooth development of the Scudderi Group of the genus *Melanoplus*. The general structure, however, satisfies us that they must be assigned to *Eotettix*.

*Type.*—♂; De Funiak Springs, Walton County, Florida. August 30, 1915. (Rehn and Hebard.) [Hebard Collection, Type No. 478.]

[14] Described from "Texas." Scudder has, in his revision, misidentified as *punctata* females of *mimica* from Goliad and Carrizo Springs and of *fratercula* from Corpus Christi Bay.

[15] In honor of our good friend Mr. William T. Davis, of Staten Island, New York, whose careful collecting trips in Florida and publications have helped greatly in the proper understanding of the Orthoptera of that state.

Size large for the genus (averaging about as large as the maximum found in *E. signatus* Scudder); form medium, as in *signatus*. Surface well supplied with rather long microscopic hairs, as in *signatus*. Interocular space narrow, distinctly narrower than in *signatus*, *palustris* or *pusillus*. Fastigium moderately produced and shallowly concave mesad, not deeply so as in those species; frontal costa with lateral margins moderately pronounced, not as sharply carinate. Eye slightly longer than cheek. Antennae elongate, over twice as long as the elongate pronotum. Pronotum with medio-longitudinal carina moderately decided, cut only by principal sulcus, not as decided as in *signatus*, *palustris* or *pusillus;* caudal margin of pronotum very broadly obtuse-angulate produced. Tegmina very slightly overlapping, broadly oval, showing some truncation distad particularly in the distal marginal portion of the lateral field, as long as prozona and half the metazona; humeral angle distinct, the dorsal field being feebly but appreciably defined from the lateral field. Distal portion of abdomen not enlarged. Furcula consisting of two, nearly attingent, slight convexities, from each of which project beyond the segment a minute rounded projection, the length of which approximates its width. Supra-anal plate moderately broad shield-shaped; lateral margins subsinuous, weakly convex to the rounded apex; surface rather decidedly concave laterad in proximal two-thirds, mesad raised, strongly sulcate in proximal third with lateral margins of this sulcation strongly carinate. Cercus a broad plate, slightly less than twice as long as its basal width, surface deplanate; margins feebly convergent to the rather broad, rounded apex, dorsal margin weakly concave, ventral margin weakly convex. Subgenital plate small, convex, tapering to the rather large and produced rounded apex, which is situated mesad on the dorsal free margin (in this respect differing from *signatus*, *palustris* and *pusillus*, in which the subgenital plate bears a distinctly subapical tubercle). Prosternal spine stout, moderately elongate, blunt. Interspace between mesosternal lobes considerably over twice as long as its least width. Caudal femora medium, slightly heavier than in *signatus*. Caudal tibiae with twelve spines (on each margin).

*Allotype.*— ♀ ; same data as type. [Hebard Collection.]

Agrees with male except in the following features. Size much larger, form much more robust. Eye no longer than cheek. Tegmina with dorsal field more distinctly defined from lateral field. Ovipositor valves moderately elongate, not strongly curved distad to their acute apices. Prosternal spine heavier than in male. Interspace between mesosternal lobes about one and one-half times as long as least width.

*Measurements (in millimeters)*

| ♂ | Length of body | Length of pronotum | Length of tegmen | Width of tegmen | Length of caudal femur |
|---|---|---|---|---|---|
| *Type.* | 21 | 5 | 4.3 | 3 | 12.1 |
| *Paratypes* (87). | 18.5–22 | 4.8–5.2 | 4.1–5.1 | 2.8–3.1 | 11.7–12.9 |
| ♀ | | | | | |
| *Allotype.* | 26.2 | 6.8 | 5.1 | 3.8 | 15.8 |
| *Paratypes* (30). | 25–27.2 | 6.3–7 | 4.2–5.7 | 3.2–3.9 | 14.8–15.7 |

Considerable variation is shown by the size and length compared with breadth of the tegmina in this series, but in all the specimens these organs are distinctive from those of *quercicola*, as discussed under that species.

*Coloration.*—Male. Face varying from russet to yellowish. Eyes dark brown. Antennae ferruginous. Occiput, disk of prozona and entire metazona and dorsal field of tegmina sayal brown, individually varying to warm sepia. Lateral fields of tegmina slightly darker than dorsal field of the same. Head showing a broad postocular band of black, which is much broader on the pronotum, continued to the principal sulcus and occupying nearly the entire dorsal half of the lateral lobes; remaining portions of lateral lobes cephalad of principal sulcus clay color, rarely with a very weak olivaceous tinge. Abdomen clay color, other portions of ventral surface yellowish. Cephalic and median femora clay color, often with an olivaceous tinge (in some specimens isabella color). Caudal femora with external face sayal brown, individually varying to warm sepia, with a broad pregenicular yellowish annulus; ventral surface yellowish with a greenish tinge; dorsal surface buffy with two broad transverse bands of dark brown, which bands are very frequently individually citrine; genicular areas very dark, blackish brown except the distal portions of the genicular lobes which are paler. Caudal tibiae coral red, spines black.

Female (recessive). General coloration of dorsal surfaces ochraceous-tawny, paling to ochraceous-buff laterad and on the occiput. Head showing a narrow postocular black band, continued as a very narrow line along the dorsal margins of the lateral lobes of the pronotum to the principal sulcus. Eyes hazel. Tegmina appreciably bicolored, dorsal field ochraceous-tawny, lateral fields ochraceous-tawny washed with cinnamon-brown. Underparts yellowish. Caudal femora unicolorous, the genicular areas alone showing traces of black. Caudal tibiae coral red; spines black, except at bases which are pink. In the maximum intensive coloration females are almost as dark as males, the postocular bar very broad on the prozona, spreading over nearly half of the surface of the lateral lobes, with ventral margin frequently irregular and sometimes with a spot of the pale ground coloration showing through mesad, this bar continued more narrowly on the metazona to the caudal margin. Tegmina with dorsal field cinnamon-brown, lateral fields prouts brown. Caudal femora showing the bands of the dorsal surface, but not as pronounced as in the male.

The series at hand shows that in the immature instars two distinct color phases occur, at least in females; in one the general coloration is yellowish green[16] (14), in the other brown (18), the postocular dark bars in all variably well defined, except in a few of the yellowish green individuals.

*Specimens Examined*: 158; 93 males, 32 females, 1 immature male and 32 immature females.

FLORIDA: De Funiak Springs and Pensacola.

A series of eighty-nine males and thirty-one females from De Funiak Springs, bearing the same data as the type, are here designated as paratypes. All of the material of this species was taken by Rehn and Hebard between August 28 and 30, 1915.

[16] Light green with a yellowish tinge in life.

The species was found very rare in gallberry bushes, *Ilex glabra*, in low sandy long-leaf pine woods, *Pinus palustris*, at Pensacola. At De Funiak Springs in sandy long-leaf pine woods, with undergrowth of wire-grass and much oak shoots and dwarf oak, the insect was found in large numbers, locally wherever this type of country occurred, the oak undergrowth evidently being the food plant as was also found to be true for the allied *quercicola*. The species is truly thamnophilous, not rapid in its movements, but jumping with great power. When approached, individuals often hid on the underside of the oak leaves and when seized by a cautious approach and sudden grasp were found to cling tenaciously to their support.

**Eotettix quercicola** new species (Plate VIII, fig. 14.)

This species agrees closely with *E. davisi*, here described, in both general appearance, habits and actions. The present insect supplants *davisi* in Florida east of De Funiak Springs.

This species is readily distinguished from *davisi* in the male sex by the very different cerci and appreciably broader apex of the subgenital plate, and in both sexes by the tegmina, which show no distal truncation and have their surfaces even, showing no definition between the dorsal and lateral fields. The males of this species also average distinctly less attenuate, while the females show the postocular dark bars in their maximum intensification narrower than is normal in *davisi*, with coloration of the same solid and ventral margins not irregular.

*Type*.—♂; Woodville, Leon County, Florida. September 1, 1915. (Rehn and Hebard.) [Hebard Collection, Type No. 479.]

Agrees in all respects with the type of *davisi*, except in the following features. Size moderately large (average somewhat smaller than in *davisi*); form medium, not as attenuate as in that species. Pronotum with medio-longitudinal carina not fully as decided as in *davisi*. Tegmina slightly overlapping, oval, the curvature of the margin greatest distad, surface showing no definition between dorsal and lateral fields. Supra-anal plate as in *davisi* except that a transverse carina runs for a brief distance laterad from the extremities of the carinae, bounding the proximal median sulcus. Cercus slightly over twice as long as proximal width, dorsal margin very feebly concave to apex, ventral margin feebly convex and converging toward dorsal margin in proximal three-quarters, the remaining narrow distal fourth of the cercus curved inward, with margins parallel to the rounded apex, this portion about one-third as wide as the basal width. Subgenital plate as in *davisi* except that it is somewhat more produced,

with apex decidedly broader, over twice as wide as deep and feebly bilobate. Interspace between mesosternal lobes in length distinctly less than twice its least width. Caudal tibiae with (eleven and twelve) spines.

*Allotype.*— ♀ ; same data as type. [Hebard Collection.]

Agrees with male except in the following features. Size much larger, form much more robust. Eyes slightly shorter than cheek. (Tegmina similar, this feature serving best to separate females of this species from *davisi.*) Ovipositor valves moderately elongate, not strongly curved distad to acute apices. Interspace between mesosternal lobes scarcely longer than broad.

*Measurements (in millimeters)*

| ♂ | Length of body | Length of pronotum | Length of tegmen | Width of tegmen | Length of caudal femur |
|---|---|---|---|---|---|
| *Type.* | 19.7 | 4.7 | 4.2 | 2.3 | 11.7 |
| *Paratypes* (28). | 17.2–21 | 4.7–5 | 4–4.8 | 2.7–2.8 | 11.3–11.9 |
| Carrabelle, Florida. | 16.3 | 4.1 | 3.9 | 2.6 | 10.5 |
| Ocala, Florida. | 20.8 | 5.2 | 4.7 | 3 | 12.3 |
| ♀ | | | | | |
| *Allotype.* | 27.7 | 6.8 | 5.8 | 3.7 | 15.1 |
| *Paratypes* (34). | 24.3–28.2 | 6–7 | 5–6.8 | 3.6–4 | 14.2–15.6 |
| Carrabelle, Florida. | 23.2 | 5.8 | 5.1 | 3.6 | 13.5 |
| Ocala, Florida. | 30.5 | 7.2 | 5.9 | 4.2 | 16.5 |

The size average is decidedly less for the Carrabelle material than for the series from Woodville, decidedly greater than that series for the Ocala specimens. Material from additional localities will be needed to determine whether the difference is attributable to geographic distribution or merely to different local environmental conditions.

The coloration is almost identical with that of *davisi,* the only noteworthy feature being the postocular dark bands in the female. This band averages narrower and is rarely continued beyond the principal sulcus in the females from Woodville and Carrabelle. In the eight females from Ocala it is decidedly broader, but shows no irregularities of its ventral margin or mesal pale marking, as it does when developed to this degree in *davisi.*

The three immature females at hand from Woodville are solidly greenish yellow, with face and disk of pronotum weakly suffused in two, but showing no trace of postocular bars. These are from the series showing greater recessive coloration and immatures from Ocala would probably show the same features found in *davisi.*

*Specimens Examined*: 84; 36 males, 45 females and 3 immature females.

Florida: Woodville, Carrabelle and Ocala.

A series of twenty eight males and thirty four females from Woodville, bearing the same data as the type, are designated paratypes. The entire series was taken between September 1 and 19, 1915 and 1917, by Rehn and Hebard.

The species was found common in sandy long-leaf pine, *Pinus palustris*, flatwoods among dwarf oaks and oak shoots at Woodville; very few in scrub oaks and oak shoots on flat sandy soil at Carrabelle, and few in oak clumps at from two to five feet from ground at Ocala, in an environment very similar to that of Woodville. The species, like *davisi*, is thamnophilous, not rapid in movements, but extremely powerful in leaping and unusually able in hiding in the oak undergrowth to which it is peculiar.

### HESPEROTETTIX Scudder

The species of this genus are extremely difficult to define properly. The male genitalia, of such great diagnostic importance in so many species of the Melanopli, show no differences of value between many of the species. Moreover, features of coloration afford important factors in separating certain species, though in some a decided amount of color variation occurs. Virtually all the color variation within a species is attributable to intensification and recession of the color pattern, but it is clear that, with this in mind, great care must be exercised in attributing specific diagnostic values to features of coloration. Furthermore it is apparent that great reduction in the organs of flight constitute a valid reason for separating more than one species from a long-winged species showing very slight additional differences, though in other genera of the Melanopli (*Melanoplus*, *Dendrotettix*) species occur in which both these conditions are found, in some being ascribable to nothing more than individual variation.

We admit that the features used below are in some cases not as satisfactory as could be desired, but their sum total shows an insect widely different in general appearance from its nearest allies. We are confident that future studies in the chromosomes and internal anatomy of these species will prove them far more distinctive than might be supposed.

**Hesperotettix gemmicula** new species (Plate VIII, fig. 15.)

This, the smallest of the Eastern species of the genus, is in our opinion the handsomest of the known forms.

Nearest relationship is with *H. osceola*, here described, under which species a comparison is made. These species belong to the

Pratensis Group, of which *osceola* is the only member having greatly reduced tegmina and wings.

Compared with *H. brevipennis* (Thomas) the present insect is seen to average smaller and more slender, the medio-longitudinal pronotal band is paler, usually paler mesad than laterad, the dark marking of the lateral lobes of the pronotum is very broadly bordered by white ventrad, the tegmina reach to the apex of the abdomen or slightly beyond and are green except for a longitudinal humeral band, the caudal femora show faintly two transverse bars on their dorsal surfaces and do not have their external faces washed with pink.

*Type.*—♂; Carrabelle, Franklin County, Florida. September 2 to 3, 1915. (Rehn and Hebard.) [Hebard Collection, Type No. 481.]

Size small for the genus, form slender. Eyes very slightly more prominent and showing a less decided difference between length and width than in *brevipennis*. Medio-longitudinal dorsal band of pronotum not solidly pink, the median portion distinctly paler than the margins. Dark bar of prozonal portion of lateral lobes solid in coloration, the ventral border of this bar white and about equally broad (in a few specimens of the series narrower, this feature then showing no difference from *brevipennis*). Tegmina and wings fully developed, as in *H. pratensis* Scudder, extending nearly to apices of caudal femora (in the males at hand varying slightly, minimum extending to apex of abdomen, maximum to apices of caudal femora). Tegmina distinctively colored; dorsal and lateral fields green except for a broad longitudinal humeral band of pink (the dorsal portion of this band in the lateral field usually darkened). Genitalia of the same general type as found in *pratensis* and *brevipennis*;[17] cerci alone differing in being narrow and of subequal width in distal half, moderately incurved in this portion, with apex sharply rounded. Prosternal spine shorter and stouter than in *brevipennis*, tapering more rapidly in distal portion to the sharply rounded apex. Antennae and broad annuli of cephalic and median femora similar to *brevipennis*, except that they are not as brilliantly colored. Caudal femora green, the pregenicular pinkish annulus distinct (but individually variable, and obsolete in a few specimens at hand); dorsal surface pale green with two weak but distinct broad transverse bands of darker green[18] and showing no trace of pink along the external margin as is characteristic of *brevipennis;* external surface green (never washed with pink as in *brevipennis*); dorsal half of lateral portions of genicular areas black as in *brevipennis*.

[17] In the present genus slight individual variation in the form of the subapical tubercle of the male subgenital plate occurs.

[18] These bands are exceedingly delicate and in poorly dried material might easily be obscured. No trace of such marking ever occurs in *brevipennis*.

*Allotype.*— ♀ ; same data as male. [Hebard Collection.]

Agrees with type except in the following features. Size larger, form slightly more robust (averaging decidedly smaller and more slender than in females of *brevipennis*). Diagnostic features of coloration as given for male, except that the medio-longitudinal dorsal stripe of the pronotum is proportionately narrower (normally for the series, but in a few specimens proportionately fully as wide as in the male and unicolorous, not paler mesad than laterad), and longitudinal humeral band of the tegmina proportionately much narrower, so that more of the surface of the insect is green. Ovipositor valves normal for the genus.

*Measurements (in millimeters)*

| ♂ | Length of body | Length of pronotum | Width of pronotum | Length of tegmen | Length of caudal femur |
|---|---|---|---|---|---|
| *Type.* | 15.2 | 3.9 | 2 | 10.8 | 9.5 |
| *Paratypes* (4). | 14.5–15.3 | 3.7–4 | 1.9–2 | 9.7–11.5 | 9.2–10.2 |
| Pensacola, Florida (4). | 14.5–15.5 | 3.6–4.1 | 1.9–2.2 | 11.7–13 | 8.8–10.4 |
| ♀ | | | | | |
| *Allotype.* | 17.9 | 4.8 | 2.7 | 11.9 | 11.7 |
| *Paratypes* (6). | 16.8–20.8 | 4.1–4.8 | 2.3–2.7 | 11.4–12.8 | 10.2–12 |
| Pensacola, Florida (7). | 18.2–23.3 | 4.8–5.7 | 2.7–3.1 | 14.6–15.5 | 11.2–12.8 |

The Pensacola series shows no difference from that from Carrabelle, except in the slightly but distinctly longer tegmina and wings and in a greater size variation between the extremes. This species occurs in very dry environment and at Pensacola was taken at two widely separated situations, the optimum examples coming from the less extreme of these. The Carrabelle examples were all taken over an area showing the extreme condition of dryness and much more exposed to storms than at the points about Pensacola where the insect was collected. It would appear from the evidence that local environmental conditions explain all the size variation which occurs, while it is probable that the slight reduction in tegminal length is a response to the more exposed and wind-swept character of the coast at Carrabelle.

Head courge green, usually with a very small black marking extending ventrad from the lower margin of the eye. Eyes metallic cinnamon brown. Antennae vinaceous-rufous. Pronotum courge green; with a medio-longitudinal band, which is flesh color with lateral margins heavily but narrowly suffused with cameo brown; lateral lobes with a broad blackish band, slightly ascendent cephalad, which extends caudad to the principal sulcus and is

bordered ventrad by a band of white of about equal width. Other lateral portions of thorax courge green; the meso-episternum ventrad with a blotch of vinaceous-russet, deepening in color mesad; the meta-episternum occupied by a broad oblique white marking, margined above and below with black. Tegmina courge green with a broad longitudinal humeral band of congo pink, this much suffused with cameo brown toward the dorsal margin of the lateral field. Abdomen dull green yellow, the dorsal segments margined laterad with white. Cephalic and median limbs courge green, their femora almost completely occupied by very broad bands of salmon-orange to orange-rufous. Caudal femora (usually) showing a broad pregenicular annulus of orange-rufous; dorsal surface courge green with two broad transverse bars of slightly darker shade; external face light hellebore green paling to courge green proximad with ventral margin of same color as ventral surface, bright chalcedony yellow; dorsal half of lateral portions of genicular areas black. Caudal tibiae lumiere blue. The variation in the series of the more important features of coloration is given with the original description.

*Specimens Examined*: 23; 9 males and 14 females.

FLORIDA: Big Bayou near Pensacola, Pensacola and Carrabelle.

A series of four males and six females, in addition to the type and allotype, bearing the same data, are designated paratypes. The entire series was taken between August 28 and September 2, 1915 by Rehn and Hebard.

The species is peculiar to very sandy areas; at Big Bayou it was found occasional in a bushy low sand-loving plant, at Pensacola very scarce among the undergrowth of scant grasses and sand-loving plants in forest of long-leaf and small sand pines. At Carrabelle very few were taken through the low bushes of the sand dune areas, which are covered heavily with arenicolous shrubs and bushes and some scrubby pine and oaks. Only with particular effort was it possible to secure the series. Heavy beating was found to be the most productive method.

**Hesperotettix osceola**[19] new species (Plate VIII, fig. 16.)

This species is closely related to *H. gemmicula*, here described, but is readily separated by the very abbreviate tegmina which in length average near that of the pronotum. Additional features of difference are: the normally narrower dark marking of the lateral lobes of the pronotum, with white marginal marking ventrad usually not reduced and the unicolorous dorsal surfaces of the caudal femora.

[19] War chief of the Seminole Indians in Florida.

The similarity in general type of color pattern, particularly that of the tegmina, shows the affinity of these species and distinguishes them from the other species of the Pratensis Group.

*Type.*—♂; Ocala, Marion County, Florida. September 19, 1917. (Rehn.) [Hebard Collection, Type No. 482.]

Agrees with the type of *gemmicula* except in the following features. Size (averaging in series) larger; form slender, slightly more robust than in *gemmicula*. Dark bar of prozonal portion of lateral lobes of pronotum narrow and solid in coloration, the ventral border of this bar white (as broad in the type, twice as broad or slightly more than twice as broad as the bar in the other specimens). Tegmina greatly reduced, appreciably shorter than pronotum (varying in series to very slightly longer than pronotum), slightly overlapping; form broad ovate, the dorsal field being distinctly defined from the lateral field. Tegmina distinctively colored, as in *gemmicula*; dorsal and lateral fields green except for a rather broad longitudinal humeral band of pink, the dorsal portion of this band in the lateral field darkened. Genitalia as in *gemmicula*, except that the cerci in the narrow distal portion have their margins feebly convex.[20] Caudal femora green, the pregenicular pinkish annulus broad and distinct, no transverse bands occur on dorsal surface as in *gemmicula*, or pink suffusion on external face and external margin of dorsal surface as in *H. brevipennis* (Thomas).

*Allotype.*—♀; taken in coitu with type. [Hebard Collection.]

Agrees with type except in the following features. Size much larger, form more robust. Diagnostic features of coloration as given for the male, except that the medio-longitudinal dorsal stripe of the pronotum is decidedly broader, pale, with very dark margins and is continued on the abdomen to near its apex. Ovipositor valves normal for the genus.

*Measurements (in millimeters)*

| | Length of body | Length of pronotum | Width of pronotum | Length of tegmen | Width of tegmen | Length of caudal femur |
|---|---|---|---|---|---|---|
| ♂ | | | | | | |
| *Type.* | 18.5 | 4.7 | 2.4 | 4 | 2.3 | 11.7 |
| *Paratype.* | 16.1 | 4.2 | 2.2 | 3.8 | 2.3 | 11.7 |
| ♀ | | | | | | |
| *Allotype.* | 24.5 | 5.7 | 3.3 | 4.7 | 3.1 | 14.3 |
| *Paratype.* | 24.2 | 5.7 | 3.3 | 5.8 | 3.5 | 15 |
| De Leon Springs, Florida. | 21.4 | 5.1 | 3.1 | 4.8 | 2.9 | 13.2 |

The coloration and color pattern of this insect shows no important differences from that of *gemmicula*. It is possible that this insect may eventually prove to be a geographic race of that

[20] In this genus, showing so little differentiation in the simple type of cerci, we believe that frequent slight individual variation will be found to occur and that such difference as here given may prove to be of very little diagnostic value.

species, but we have no evidence of this as yet. We suggest this since a very similar condition in *H. gillettei* is clearly only of geographic racial value in that case, as treated below.

*Specimens Examined*: 6; 2 males and 4 females.

FLORIDA: Ocala and De Leon Springs.

A male bearing the same data as the type and a female taken the following day by Hebard are designated paratypes. The series was taken between September 8 and 20, 1917 by Rehn and Hebard. The species was exceedingly scarce, very long search on four days having been made to secure the six examples. It was evident that the date was very late for this species, as three of the specimens when taken had each lost one of the caudal limbs.

Like *gemmicula* the species was found peculiar to very sandy areas. At De Leon Springs one individual was beaten from a dwarf oak in a wide sand scrub area, the other from dwarf oaks, bay cedar and other bushes more than a mile distant in the sand scrub. At Ocala the four specimens were secured in sandy flatwoods by beating the undergrowth, which was composed of a leguminous plant and bunch grass.

**Hesperotettix nevadensis termius**[21] new geographic race (Plate VIII, fig. 17.)

This geographic race is based on a condition showing greatly reduced tegmina and wings, developed over an apparently restricted area of the species' distribution. Comparable with this is *Melanoplus occidentalis brevipennis* Bruner.[22] In both these species such a condition is constant over a certain area, elsewhere in their distribution never being found[23]; in the present species intermediates from the regions of intergradation with *nevadensis gillettei* are at hand.[24] It is possible that *H. osceola*, may prove to

[21] From τέρμιος = last; as showing the highest specialization in this species.

[22] Described as *flabellifer brevipennis*. We find *Melanoplus flabellifer* Scudder to be an absolute synonym of *Melanoplus occidentalis* (Thomas).

[23] We would note that in the normally short-winged *Melanoplus scudderi* (Uhler) a long-winged condition is found, though very rarely. In that species the structure of the tegmina shows that such a condition is wholly attributable to individual reversion to the primitive type, and should in no way receive nominal recognition.

[24] Without the large series at hand it would be impossible to determine the correct value of the features shown by the present material.

be a similar race of *H. gemmicula*, both species here described, but we have no evidence as to this, and it is clear that *H. floridensis* Morse is similarly derived from a common stock with *H. speciosus* (Scudder), though still further specialized and no question of its specific validity now being possible.

The present species is a member of the Viridis Group, and *H. gillettei* Bruner represents another geographic race widely distributed over the central Rocky Mountain region.

We have discussed this question as to values of tegminal differentiation here, to show how absolutely essential it is to judge each case separately. Dogmatic treatment is utterly impossible.

*Type.*—♂; Milford, Beaver County, Utah. Elevation 4900 feet. September 5, 1909. (Rehn and Hebard.) [Hebard Collection, Type No. 483.]

Agrees fully with the type of *nevadensis gillettei* except in the following characters. Size (averaging in series) smaller. Tegmina greatly reduced, slightly shorter than pronotum, slightly overlapping, somewhat truncate distad; tegminal form broad ovate, the dorsal field being distinctly defined from the lateral field.

The type is yellowish brown in general coloration, the color pattern is discussed below.

*Allotype.*— ♀ ; same data as type. [Hebard Collection.]

This specimen agrees fully with the type except in the following features. Size larger. Tegmina broadly quadrato-ovate, due to the somewhat greater distal truncation; separated from each other by a brief interspace.

The allotype is brilliantly colored, with color pattern intensive as discussed below. General coloration dull green-yellow (a bright color).

*Measurements (in millimeters)*

| ♂ | Length of body | Length of pronotum | Length of tegmen | Width of tegmen | Length of caudal femur |
|---|---|---|---|---|---|
| *Type.* | 13.5 | 3.2 | 3.1 | 1.8 | 8.4 |
| *Paratype.* | 13.8 | 3.6 | 3.1 | 1.8 | 8.2 |
| Caliente, Nevada (4). | 12.9–13 | 3.1–3.2 | 3.8–3 | 1.5–1.7 | 7.7–7.6 |

*Measurements (in millimeters)—continued*

| ♀ | Length of body | Length of pronotum | Length of tegmen | Width of tegmen | Length of caudal femur |
|---|---|---|---|---|---|
| *Allotype.* | 19.7 | 4.3 | 3.7 | 2.2 | 9.7 |
| *Paratypes* (5). | 17.1–20.4 | 3.9–4.5 | 3.1–4.5 | 2–2.5 | 9.4–10 |
| Crestline, Nevada (1). | 19 | 4.1 | 3.3 | 2.1 | 9.8 |
| Caliente, Nevada (2). | 19.5 | 4.2–4.3 | 5.4–5.9 | 2.3 | 10.1–10.2 |

The Caliente series is atypical in having the tegmina lanceolate rather than truncate distad, these organs in the females being distinctly more elongate. This is clearly a slight divergence toward the condition of the typical race.

Several specimens of *nevadensis gillettei* from Tintic, Utah, on the other hand, show divergence toward the present race in having the tegmina reduced, decidedly variable in the series, proving that locality to be in the area of intergradation.[25]

*Coloration.*—A brilliant green and a yellowish brown phase of coloration are found in *nevadensis termius*. In the most vividly green individuals the color pattern shows its maximum intensification. The head has two postocular and one subocular whitish line on each side, the more dorsal of the postocular bars margining the eyes in the occipital region, which region also has a pale medio-longitudinal suffusion. The pale medio-longitudinal band of the pronotum is conspicuous, dark margined, and so continued to near the abdominal apex. The pronotal lateral lobes have a pale band above and below the dark marking. The tegmina are green, dark along the costal margin, with a weakly defined pale line above this and another near the sutural margin. The caudal femora have the pregenicular pink annulus decided, the dorsal surface pale and (normally) with two slightly darker transverse bands weakly defined,[26] the external face rather dark green with a narrow pale ventral border of the same greenish yellow as the ventral surface.

In the remaining specimens this type of coloration is found, but the markings are variously less striking and blurred. Comparison with series of *nevadensis gillettei* shows the coloration of that race to be very similar, specimens nearly identical with each individual here examined being obtainable. In that race, however, the large majority are of a rich brown color phase with color pattern intensive, and nearly all have the dorsal marginal band of the lateral lobes of the pronotum broader and extending over the lateral portions of the pronotal disk.

[25] One specimen has fully caudate tegmina, a condition not shown in any other example of the considerable series of *nevadensis* before us.

[26] In *nevadensis nevadensis* these bands are normally strongly defined, in *nevadensis gillettei* they are normally obsolete.

*Specimens Examined:* 15; 6 males and 9 females.

UTAH: Milford.

NEVADA: Crestline and Caliente in Lincoln County (material from the latter locality somewhat atypical).

A series from Milford, of one male taken September 18, 1908, by J. C. Bradley and five females bearing the same data as the type and allotype, are designated paratypes. All but the specimen referred to above were taken by Rehn and Hebard between September 3 and 5, 1909.

The species was found very scarce in weedy areas of valley bottoms at Milford and Caliente, particularly in a yellow-flowered, feathery, green plant of the daisy family, growing solidly waist-high over large areas. Every effort was made to secure a good representation, the material being obtained by long and continuous beating. Earlier in the season the insect is probably more numerous.

### ARGIACRIS[27] new genus

This monotypic genus is placed after *Asemoplus* and before *Bradynotes* in linear arrangement. In general appearance closest resemblance is found to *Bradynotes*, but from that genus it is readily separated by the pronotum which has the disk distinct from the lateral lobes, but showing no acute marginal carina on each side and the caudal margin obtuse-angulate produced, by the presence of very broadly lanceolate tegmina, and, in the female, by the fully exposed ovipositor valves. In this last feature it agrees rather with *Asemoplus*. Though the produced caudal margin of the pronotum distinguishes this genus from the genera following *Melanoplus*, viz.—*Dendrotettix*, *Podisma*, *Asemoplus* and *Bradynotes*, the general character of its robust structure, broad vertex, small eyes and general character of male genitalia show that it belongs with these genera and not with *Melanoplus* and allied genera.

*Genotype.*—*Argiacris rehni* new species.

*Generic Characters.*—Form very stout. Head as in *Bradynotes*. Interocular space wide; vertex blunt; eyes small, very much shorter than cheeks. Pronotum with disk rounding rather broadly into lateral lobes, caudal margin obtuse-angulate produced. Abbreviate but broad tegmina present. Male genitalia

[27] From ἀργιός = slow and ἀκρίς = grasshopper.

of general type found in *Bradynotes*, small furcula present as in two of the species of that genus. Female ovipositor valves fully exposed.

**Argiacris rehni**[28] new species (Plate VIII, fig. 18.)

This distinctive insect is obscurely colored, except for the brilliant pink of the internal faces of the caudal femora ventrad and of the caudal tibiae.

*Type.*—♂; Livingston, Park County, Montana. Elevation, 5000 feet. July 29, 1909. (Rehn and Hebard.) [Hebard Collection, Type No. 480.]

Size large, form very robust. Head with interocular space half as wide as length of one of the eyes; eye small, moderately protuberant, three-quarters as long as cheek. Pronotum with disk moderately convex; medio-longitudinal carina weakly defined only on metazona; transverse sulci not deep; caudal margin broadly obtuse-angulate produced with apex broadly rounded. Tegmina very broadly lanceolate, considerably shorter than pronotum, sutural margins attingent proximad (in the series varying from slightly overlapping to separated by a brief interval), apices acute and sharply rounded. Furcula represented by two minute rectangulate projections with angles rounded, separated by a space slightly wider than one of these projections. Supra-anal plate simple, triangularly shield-shaped, lateral margins convergent and feebly convex to the rather acute apex; surface concave each side of the medio-longitudinal sulcus, which is bounded by rather decided lateral carinae to near the apex of the plate. Cercus simple, about two and one-half times as long as basal width, tapering decidedly in proximal half, distal half showing a moderate flexure dorsad, widening very feebly then very slightly and gradually narrowing to the broad, rounded apex. Subgenital plate of the general type usual in *Bradynotes*, but with an acute-conical projection meso-dorsad on the free margin. Prosternal spine short, heavy, acute-conical. Interspace between mesosternal lobes distinctly longer than least (proximal) width. Limbs robust.

*Allotype.*—♀; same data as type. [Hebard Collection.]

Similar to male except in the following features. Size larger, form more robust. Interocular space with width about two-thirds length of eye. Eye about three-fifths as long as cheek. Tegmina separated by a brief interval (width of this interval individually moderately variable). Ovipositor valves fully exposed. Prosternal spine very short and heavy, with apex acute and sharply rounded. Interspace between mesosternal lobes with length contained about one and one-third times in least width.

[28] In honor of our friend and fellow-worker, Mr. James A. G. Rehn, for whom both personally and scientifically we have the highest regard.

*Measurements (in millimeters)*

| ♂ | Length of body | Length of pronotum | Width of disk of pronotum | Length of tegmen | Width of tegmen | Length of caudal femur |
|---|---|---|---|---|---|---|
| *Type.* | 22.3 | 5.5 | 3.4 | 4.9 | 3.3 | 11.9 |
| *Paratypes* (6). | 16.9–21.8 | 5.2–5.4 | 3.3–3.4 | 4.8–5.3 | 3.1–3.3 | 11.2–11.8 |
| ♀ | | | | | | |
| *Allotype.* | 27.4 | 6.3 | 4.6 | 5.4 | 4 | 12.3 |
| *Paratypes* (2). | 28.7–29.4 | 6.3–6.2 | 4.7–4.8 | 6–5.8 | 3.8–3.9 | 12.1–12.2 |

General coloration snuff brown; paler on face, there buffy, darker on occiput and dorsum of pronotum, there tinged with sepia. Eyes verona brown. Antennae mikado brown. Underparts clay color. Caudal femora with two broad transverse blackish bands on dorsal surface, the first continued on the external face and running obliquely proximad half way across, the more distal crossing the external face vertically, there broader but more obscure. Caudal tibiae and ventral face of femora brilliant jasper red.

Little color variation is shown by the series, in the paler examples the general color is slightly lighter and the transverse dark bands of the dorsal surfaces of the caudal femora are not continued on the external faces.

In addition to the type and allotype, a series of six males and two females, bearing the same data, are designated paratypes.

This series was captured on the ridge of a slope of a bare hogback showing numerous cherty exposures. The ground there showed rather scant vegetation with tufts of a peculiar woolly plant all about. Careful and intensive collecting was necessary to secure the ten specimens, apparently members of a single colony, taken over a very restricted area.

## Explanation of Plate VIII

Fig. 1.—*Gymnoscirtetes pusillus* Scudder. Supra-anal plate of male (*type*) Jacksonville, Florida. (× 21)

Fig. 2.—*Gymnoscirtetes pusillus* Scudder. Outline of cercus of male (*type*) Jacksonville, Florida. (× 32)

Fig. 3.—*Gymnoscirtetes pusillus* Scudder. Caudal view of subgenital plate of male (*type*). Jacksonville, Florida. (× 21)

Fig. 4.—*Gymnoscirtetes morsei* new species. Supra-anal plate of male (*type*). (× 21)

Fig. 5.—*Gymnoscirtetes morsei* new species. Outline of cercus of male (*type*). (× 32)

Fig. 6.—*Gymnoscirtetes morsei* new species. Caudal view of subgenital plate of male (*type*). (× 21)

Fig. 7.—*Phaulotettix eurycercus* new species. Cercus of male (*type*). (× 25)

Fig. 8.—*Phaulotettix eurycercus* new species. Caudal view of subgenital plate of male (*type*). (× 12)

Fig. 9.—*Phaulotettix compressus* Scudder. Outline of cercus of male. Uvalde, Texas. (× 25)

Fig. 10.—*Chloroplus cactocaetes* new genus and species. Cercus of male (*type*). (× 22)

Fig. 11.—*Paraidemona latifurcula* new species. Dorsal view of supra-anal plate and preceding segment of male (*type*). (× 15)

Fig. 12.—*Paraidemona fratercula* new species. Dorsal view of supra-anal plate and preceding segment of male (*type*). (× 15)

Fig. 13.—*Eotettix davisi* new species. Outline of cercus of male (*type*). (× 25)

Fig. 14.—*Eotettix quercicola* new species. Outline of cercus of male (*type*). (× 25)

Fig. 15.—*Hesperotettix gemmicula* new species. Dorsal view of caudal femur of male (*type*). (× 3)

Fig. 16.—*Hesperotettix osceola* new species. Dorsal view of tegmen, seen from directly above, in normal position. *Paratype*. (× 6)

Fig. 17.—*Hesperotettix nevadensis termius* new race. Dorsal view of tegmen, seen from directly above, in normal position. *Paratype*. (× 6)

Fig. 18.—*Argiacris rehni* new genus and species. Dorsal view of male (*type*). (× 2½)

# THE EVOLUTION OF THE ABDOMINAL PATTERN IN TABANIDAE (DIPTERA)[1]

BY WERNER MARCHAND

There are certain acknowledged and well-known principles by means of which it can be ascertained whether a given type of pattern is primitive or derived, and by which, among a number of given patterns, the most primitive of them may be determined. A form in which the same elements of pattern are repeated on all segments of the abdomen, and in the same relative position on each of them, will be considered more primitive than a form where this same pattern is found only on one or a few of the segments while the others are of uniform color, or show a different pattern. In the internal as well as in the external anatomy of the segments we possess numerous instances of a specialized development of single segments, a character which is always considered as derived or secondary. In general, though not in all cases, we will then have to assume that characters which potentially existed in all segments, have been preserved and further specialized only in certain of them, while in the others every trace of them has disappeared. Or it may be that the specialization of originally equal elements took place in divergent directions. In the case of abdominal patterns, fusion of spots may take place in one segment, suppression of spots in others, etc. The second characteristic of primitiveness is, consequently, the homeotropic isotropism of pattern, as we may call it: the even distribution of the elements of pattern in the segment and on the whole abdomen, relatively to size, degree of pigmentation, condition, etc., of these elements. If the elements of pattern are evenly distributed over the segment, or its dorsal and ventral surface, we are confronted with a more primitive condition than in the case of an uneven pattern. A pattern consisting of a definite number of spots of the same size and in equal distance from one another, is more primitive than a pattern consisting of large spots on the median line and small or no spots on the sides. The absence of any definite pattern, then, will always have to be considered

[1] From the Department of Animal Pathology of the Rockefeller Institute for Medical Research, Princeton, N. J.

as a derived condition, if it can be shown that existing traces or rudiments of pattern are themselves the remainders of a derived type, so that the possibility is excluded that they might be a sort of pattern *in statu nascendi*. If patterns appear *de novo*, it should be assumed that they will appear in places where the physiological conditions for their appearance are in evidence; it would be astonishing if a pattern would appear as the result of a number of simultaneous but otherwise entirely unrelated changes, while by a single change in the germ plasm either a homogenous coloration, or, if any pattern, a more or less isotropic pattern will be developed, showing at most a relationship to the borders of the segments or other preferential localizations.

These principles are sufficient to classify the abdominal patterns of Tabanidae as to their phylogenetic value or relative degree of evolutionary specialization. It should be kept in mind, however, that here no classification of species is intended; this would be entirely impossible on such basis, as often male and female of the same species represent divergent types of pattern of very different degree of specialization. For the larger groups, subgenera, etc., often a certain degree of specialization is characteristic, but not unfrequently one or two species, or one sex of a species, will show a pattern which is more frequently encountered in another systematic category, lower or higher in the system, as the case may be.

The most primitive type of abdominal pattern which I was able to find in Tabanidae, is found in the genus *Haematopota* and in a number of species of *Tabanus* which are evidently related to *Haematopota*. This pattern consists of alternating dark and light elements of medium size, usually five light spots separated by dark on each segment, so that a light spot occupies the middle of the dorsal side of each segment, while two others, which we may call the sub-dorsal and lateral spots, occupy the sides. One will not expect to find everything perfect and to one's wishes in nature; in fact, even in the most generalized forms of which I found illustrations, this ideal pattern is shown slightly modified, and so, especially on the first and again on the last segments of the abdomen in the example of *Haematopota brunnescens* (fig. 1), an African species, show that the lateral spots are preserved only on

segments one to four, while on segments five to eight they have been swallowed by the dark background. Phenomena of this kind are so frequently observed that they do not detract anything from the soundness of the assumption that the five-spotted segment represents the primitive condition. It seems that processes of reduction of pattern always begin at both ends of the abdomen, but progress more rapidly from the posterior end while the middle region is more conservative. On the other hand it is likely that sometimes in a fresh specimen the presence of vestigial spots may be ascertained on more segments than in dry specimens or from illustrations.

The type of pattern of figure 1 is met with quite frequently in the genus *Haematopota*, and all the varieties of forms of pattern in Tabanidae can apparently be shown to be only modifications of this *Haematopota*-type. As stated, there are certain species of the genus *Tabanus* in which this pattern occurs in identical form. These are all species of small, at most medium size, among them the American species *T. pumilus, sparus, vivax*, etc.; it seems that this group comprises the smallest of all known Tabanidae. *T. sufis* (fig. 2), an African species, is of the same very small size and appearance as *H. brunnescens* (smaller than a house-fly!), and shows in its venation a character which is not usually encountered in *Tabanus*, but forms the rule in *Haematopota*. The abdominal pattern likewise recalls *Haematopota*. Here we observe a tendency of the median and subdorsal light spots to become enlarged, the subdorsal ones placed somewhat obliquely, and the median ones assuming a triangular shape with the bases of the triangles resting on the posterior border of the segments, while the lateral spots seem to have shifted to the upper corner of the segments. A series of further modifications frequent in species of *Tabanus* is already indicated here in its initial stages.

*T. mordax* (fig. 3) affords an example where the lateral spots have wholly disappeared; it is this condition from which the three-banded patterns can be derived, inasmuch as the spots of neighboring segments tend to enter a relation with each other in order to form bands over the whole length of the abdomen. In *Tabanus kingi* (fig. 4) this tendency is already marked; at the same time in segments five to seven a further reduction has taken

place, in so far as here the subdorsal spots have also disappeared and only the median spots remain. In *Tabanus lineola* (fig. 5) we have a type of pattern in which a white dorsal longitudinal band is accompanied by two black bands, and these border again on a white band which in turn is bordered by dark. This pattern may give, as the case may be, the impression of three white bands bordered by black, or of two black stripes on light ground. Frequently, as in *T. costalis*, and in *T. taeniola* (fig. 6) the lateral dark areas are rather light, so that the pattern is further simplified. The dark pigmentation even of the stripes bordering the median light band may be rather pale, so that the whole effect is one of light coloration. From dark gray with three distinct white stripes bordered by black, we have all transitions to a general olivaceous yellow color with a pale yellowish white stripe along the median line, bordered by grayish color hardly darker than the surrounding color.

Another type of modification of the primitive pattern is found when the median light spots have been greatly reduced (*T. lasiopthalmus*, fig. 7), or altogether disappeared (*T. ditaeniatus*, fig. 14). In *T. lasiopthalmus* rudiments of paired black elements are visible on segments three to five and rudiments of white triangular spots on segments three to four. Excepting these spots, the entire median stripe is lacking. On the other hand, the subdorsal spots have been retained on most segments and have been greatly enlarged on segments one and two; here they are placed obliquely, following the same tendency as already indicated in *T. sufis* (fig. 2): their outer contours have become indistinct owing to the diffusion of the lateral spots in their dark background. The disappearance of white spots on a dark background frequently has the effect of lighting up the background in grayish or brownish hues of indistinct boundary, and it is in the nature of the reduction process that these indistinct shades are most often encountered on the sides of the segments, while the middle retains a well-marked pattern.

A third type of modification is that in which the median white spots alone have been preserved, and, subsequently, undergo reduction in number or in size. We have seen in *T. sufis* (fig. 2) how the triangular form of these median spots originates: it is due to the tendency of all dark and light spots (or cross-bands)

to assume an oblique position which leaves a triangular space in the middle of each segment. This alone should indicate that where we have only triangular spots present there must have been originally a whole pattern of the type described. In *T. exul* (fig. 8) we find white triangular spots in the middle of each segment, while the subdorsal and lateral spots are still traceable in the form of ill-defined shades. Probably there are related species which will show them still present. In *Tabanus melanocerus* (fig. 9) the white triangular spots are well marked on all segments while the remainder of each segment has become infuscated. However, dark spots bordering on the white triangles are still plainly visible and even a second row of dark spots is present; between the two a slightly lighter area is included which corresponds to the subdorsal light band of forms like *T. lineola* (fig. 5). In *Tabanus trimaculatus* (fig. 10) no traces of subdorsal or lateral spots are seen, the whole abdomen is uniformly black, but the presence of the typical three white triangular spots on segments three, four, and five requires no further explanation; they are the last remainder of the abdominal pattern of *Haematopota* and of *T. sufis*. There are a great many Tabanids in which two or three such white triangles on an otherwise dark abdomen are a conspicuous character (note *T. biguttatus* Wied, a common African cattle-pest). Sometimes the triangles are combined with oblique spots on segments one and two, as already indicated in *T. lasiopthalmus* (fig. 7). From the black abdomen bearing triangles, it is not a long way to a wholly dark abdomen, as in *T. stygius* (fig. 12) a form related to *T. trimaculatus*. Forms like *T. fuscopunctatus* (fig. 11), a Florida species nearly related to *T. exul*, will illustrate the gradual disappearance of the white triangles, leading to uniform black. Needless to say that black as a final result may be reached by different processes of pattern reduction, so that in cases where the abdomen is simply black, we cannot always tell exactly in which way the pattern actually has disappeared. But in forms like *T. stygius* for instance, there is a good deal of likelihood that the black final stage was preceded by a stage marked with the triangles which are still present in the near relatives, and the same thing may be said of *T. giganteus* when compared with its relatives *T. exul* and *T. fuscopunctatus*.

Another series of pattern transformations are the result of a breaking up of the dark background into dark spots. From a glance at fig. 2 (*T. sufis*) it will be evident that the same primitive patterns from which we have started can be taken as the origin of a pattern consisting of dark spots on a light background. Such a pattern, consisting of four rows of black spots, we find on the yellowish-olivaceous abdomen of *T. ditaeniatus* (fig. 13). That this pattern must have had the same origin is all the more evident as the male of *T. ditaeniatus* (fig. 14) has a pattern which represents a modification in the opposite direction, and of a similar type as *T. lasiopthalmus:* suppression of the median row of light spots so that the resulting impression is that of two light subdorsal bands on a dark background. By reduction of dark spots on a light abdomen a uniform light coloration like that of *T. par* (fig. 15) may be derived. There is a considerable variety of indistinctly-shaded abdomina' patterns found in species of Tabanidae, of which generally the uniformly light type may be considered an end result.

Turning to the genus *Chrysops*, we find phenomena quite analogous to those described in *Tabanus*. In *Chrysops*, however, generally the initial stage is that of four rows of black spots on a light (yellow or grayish-yellow) background, as exemplified in *C. vittatus* (fig. 16). The same tendency of pattern reduction beginning from both ends of the abdomen, together with fusion of the remaining elements, takes place in *Chrysops*. The pattern variations in *Chrysops* are well known as they serve to distinguish the species. In *C. montanus* (fig. 17) the lateral black spots present in *C. vittatus* have disappeared on segments one and two; on segments three, four, and five they tend to fuse together. In *C. callidus* (fig. 18) the subdorsal black spots on segments one and two separate in *C. vittatus*, and beginning to fuse in *C. mortanus*, have fused completely, forming a new characteristic element of pattern. On segments three and four the lateral and subdorsal black spots have fused completely, leaving only narrow light areas open in the median dorsal line. On the following segments black has swallowed everything, and even on segment five, which in *C. vittatus* shows four distinct black spots on light ground, and shows the same spots less distinctly in *C. montanus*, has turned wholly black in *C. callidus*. Finally in *C. sackeni*

(fig. 19) the fused spots on segments one and two have become more rounded and only on segment three a trace of the median light area is left visible. The light borders of all abdominal segments may still preserve a trace of the original light pigmentation.

Another series of changes may be observed in those species of *Chrysops* where the lateral black spots do not fuse with the subdorsal ones but are reduced, and where the subdorsal spots themselves remain apart, leaving a distinct light longitudinal band in the middle of the abdomen. This process begins with *C. obsoletus* (fig. 20) with a pattern easily derived from that of *C. vittatus* (fig. 16), but with the light background somewhat infuscated except in the bright median dorsal area. In *C. univittatus* (fig. 21) frequently the lateral spots have wholly disappeared, while the subdorsal ones have been fused in the longitudinal direction, forming two longitudinal black stripes at both sides of a yellow longitudinal band. Sometimes the whole abdomen with the exception of this light longitudinal band is dark infuscated, or even black. In the sample given of *C. lugens* (fig. 22) a rather variable species, we find the light median band itself in a process of reduction; while, at the same time, on segment two, traces of the light subdorsal spots have been retained.

The African and South American species of *Chrysops* show essentially the same stages of transformation as the North American species. Fig. 23 shows the abdomen of the African *C. fuscipennis* where the fusion of spots in the transverse direction has been carried to an extreme, resulting in an almost wasp-like banded pattern. The South American species *C. omissus* and *C. bulbicornis* (figs. 24 and 25) represent rather primitive types of pattern, not unlike the North American *C. vittatus*. In *C. omissus* a similar tendency to form oblique spots is visible as in *T. sufis*, but the direction of the spots is the opposite in this case.

I have not been able to extend this study to all the exotic forms; however, from the samples I have seen, I find no reason to depart from this argumentation. The South American *Eisenbeckias*, of which so many have been recently described by H. Lutz, show usually a rather simple and therefore derived type of abdominal pattern, not infrequently resulting in transversely banded forms or such with entirely black or brownish abdomen. An interesting case is presented by *Eisenbeckia inframaculata* (figs. 26 and 27) in

which, while the dorsal side is of a clearly derived and much simplified type, the underside shows a spotted pattern which may well be compared with that of a *Chrysops*. However, there are only three rows of spots, the median ones not much larger than the lateral ones. I notice that while in most Tabanids the underside of the abdomen is of a uniform coloration, a number of species, as *T. trimaculatus* and its allies, show a broad, black, median, longitudinal band. If our views are correct, this band represents the last trace of an underside pattern in process of disappearance. The banded, wasp-like patterns are quite frequent among the South American forms, and *Eisenbeckia mattogrossensis* (fig. 28) is only one of the less striking examples. If these views are correct, they have to be considered as derived, not primitive types. The same will hold good for the *Pangonia* group. Here we seldom encounter anything like a primitive pattern. Of the Brazilian forms, *Bombylomyia splendens* (fig. 29) still shows an ill-defined trace of light triangles on a yellowish-brown abdomen, while the abdomen of *Erephopsis nana* (fig. 30) is almost uniformly fuscous, and that of *Erephopsis albitaeniata* (fig. 31) metallic green with whitish borders of the segments. The almost globular form of the abdomen in these bee-like species is itself an indication that we have to deal with derived, not primitive forms of abdominal coloration.

## Explanation of Plate IX[2]

[2] Figs. 1 to 4, fig. 6 and figs. 13 to 15 are drawn after H. H. King, Report on Econ. Ent., Wellc. Res. Lab. III. Report, 1910. Fig. 5, figs. 7 to 12, and figs. 16 to 22 drawn from specimens in my collection. Figs. 23 to 31 from A. Lutz, Notas Dipterolojicas, Mem. Instit. Oswaldo Cruz, Rio de Janeiro, 1911.

Fig. 1.—*Haematopota brunnescens*, ♀.
Fig. 2.—*Tabanus sufis*, ♂.
Fig. 3.—*Tabanus mordax*.
Fig. 4.—*Tabanus kingi*, ♂.
Fig. 5.—*Tabanus lineola*, ♀.
Fig. 6.—*Tabanus taeniola*, ♀.
Fig. 7.—*Tabanus lasiophthalmus*, ♀.
Fig. 8.—*Tabanus exul*, ♀.
Fig. 9.—*Tabanus melanocerus*, ♀.
Fig. 10.—*Tabanus trimaculatus*, ♀.
Fig. 11.—*Tabanus fuscopunctatus*, ♀.
Fig. 12.—*Tabanus stygius*, ♀.
Fig. 13.—*Tabanus ditaeniatus*, ♀.
Fig. 14.—*Tabanus ditaeniatus*, ♂.
Fig. 15.—*Tabanus par*, ♀.
Fig. 16.—*Chrysops vittatus*, ♀.
Fig. 17.—*Chrysops montanus*, ♀.
Fig. 18.—*Chrysops callidus*, ♀.
Fig. 19.—*Chrysops sackeni*, ♂.
Fig. 20.—*Chrysops obsoletus*, ♀.
Fig. 21.—*Chrysops univittatus*, ♀.
Fig. 22.—*Chrysops lugens* var. *morosus*, ♀.
Fig. 23.—*Chrysops fuscipennis* ♀.
Fig. 24.—*Chrysops omissus*, ♀.
Fig. 25.—*Chrysops bulbicornis*, ♀.
Fig. 26.—*Eisenbeckia inframaculata*, ♀, ventral side.
Fig. 27.—*Eisenbeckia inframaculata*, ♀, dorsal side.
Fig. 28.—*Eisenbeckia mattogrossensis*, ♀.
Fig. 29.—*Bombylomyia splendens*, ♀.
Fig. 30.—*Erephopsis nana*, ♀.
Fig. 31.—*Erephopsis albitaeniata*, ♀.

# ON DERMAPTERA AND ORTHOPTERA FROM SOUTHEASTERN BRAZIL

BY JAMES A. G. REHN

The material treated in the following pages was submitted to us for study by Dr. Herman Von Ihering, formerly Director of the Museu Paulista at São Paulo, Brazil. The first set of the material, aside from the types of the new species, has been returned to that institution, the remainder being retained, with the types of the new forms, in the collection of the Academy of Natural Sciences of Philadelphia.

The material studied has a particular appeal to us, as, while it is from a number of localities, it furnishes a considerable amount of data on the eastern distribution of many types of Orthoptera occurring in the Paraná drainage, and also gives a fairly clear idea of the relatively narrow area of distribution of many of the coast forms. The present paper presents merely the systematic study and the geographic data of the material, but at a later date, in with other information, we hope to more critically discuss the important features apparently governing the distribution of the Dermaptera and Orthoptera of southeastern Brazil.

The localities represented in the collection, with their position as far as we can ascertain from the charts and information available,[1] are as follows:

| *Locality* | *State* | *Position* |
|---|---|---|
| São João de Barra | Rio de Janeiro | At mouth of the Parahyba River. |
| Itatiaya | Rio de Janeiro | "Campo"—Apparently field conditions on or near the great peak of Itatiaya. |
| Alto do Serra | São Paulo | Pass over Serra do Cubatao between Santos and São Paulo. |
| Cantareira | São Paulo | |

[1] Much of our information relative to localities in the State of São Paulo has been gathered from: "Apontamentos Historicos, Geographicos, Biographicos, Estatisticos e Noticiosos da Provincia de S[ão] Paulo. Colligidos por Manoel Eufrazio de Azevedo Marques." Vol. I. Rio de Janeiro. 1879.

| *Locality* | *State* | *Position* |
|---|---|---|
| Estaçao Campo Grande | São Paulo | Apparently on Paraná side of coast mountains east of São Paulo. |
| Estaçao Piassaguéra .. | São Paulo | Another name for the port of Cubatao, between Santos and São Paulo, at east foot of Serra Cubatao. |
| França..... | São Paulo | Northwestern part of state, near boundary of Minas Geraës. Paraná drainage. |
| Itatiba..... | São Paulo | |
| Piquete..... | São Paulo | In coast mountain region in northwestern part of state. |
| Piracicaba..... | São Paulo | East central São Paulo on Piracicaba River, tributary of Teite River (Paraná). |
| Salto Grande..... | São Paulo | Central part of state in Paraná drainage. |
| Santos..... | São Paulo | East coast. |
| Ypiranga..... | São Paulo | Environs of São Paulo. |
| Castro..... | Paraná | Central part of state. Paraná drainage. |
| Porto Majoli..... | Paraná | |
| Hamonia..... | Santa Catharina | In eastern part of state about sixty miles from coast. |
| São Francisco..... | Santa Catharina | East coast. |
| Porto Alegre..... | Rio Grande do Sul | East coast. |

The species treated in the present paper number eighty-one, belonging to sixty-three genera, of which total nine species are described as new. The number of specimens in the series is one hundred and eighty-three.

The author wishes to thank Dr. Von Ihering and the authorities of the Museu Paulista for the opportunity to study this material.

## DERMAPTERA

### Pygidicranidae

**Pyragra brasiliensis** (Gray)

1832. *Forficula brasiliensis* Gray, in Griffith, Animal Kingdom, xv, p. 184, pl. 78, fig 2. [Brazil.]

São Paulo, State of São Paulo. February 24. (Garden field.) One female.

This individual agrees with a female from Puerto Bertoni, Paraguay.

## Labiduridae

**Labidura xanthopus** (Stål)

1855. *F[orficelisa] xanthopus* Stål, Öfv. Vet. Akad. Förh., xii, p. 348. [Rio de Janeiro, Brazil.]

Santos, State of São Paulo. October, 1907. (H. Lüderwaldt.) Two males, six females.

França, State of São Paulo. October, 1910. (E. Garbe.) Two females.

It is very probable that Borelli's *Demogorgon longipennis*[2] is a synonym of this species, as it was based apparently on no character than the presence of visible alar squamae. The present series contains two females which possess visible squamae, and we have also seen another individual of the same sex of similar character. In each case the winged type was taken with the non-winged phase and we are convinced this is a condition similar to that found in the genus *Psalis*. The species is, however, very distinct from the widely-spread "*riparia*" type; *xanthopus*, as pointed out by Borelli (vide supra), differing in the sculpturing of the male abdomen, in the shape of the pronotum and of the forceps and of the disto-dorsal abdominal segment of the male. In addition the limbs are also more slender in *xanthopus*.

## Labiidae

**Strongylopsalis iheringi** new species (Plate X, fig. 1.)

Clearly a member of the present genus and more nearly allied to *S. boliviana* (Bormans) than to *chelidiuroides* (Bormans), the genotype. The new form agrees with *boliviana* in the general size, the number of antennal joints and the general form and symmetry of the forceps. From *boliviana*, however, it differs in the greatly produced linguiform process of the pygidium and in having a decided tooth on the internal face of the male forceps.

*Type*.—♂; Itatiaya, State of Rio de Janeiro, Brazil. April, 1906. (H. Lüderwaldt; in campo.) [Acad. Nat. Sci. Phila., Type no. 5243.]

Size medium; form subdepressed; surface generally smooth, faintly impresso-punctulate on the dorsum of the abdomen. Head subtrigonal; eyes hardly at all prominent; genae subparallel caudad of the eyes, caudo-lateral angles broadly rounded; antennae composed of fourteen joints, proximal joint

[2] Boll. Mus. Zool. Anat. Comp. Torino, xix, no. 479, p. 4.

moderately robust, in length subequal to the third, second joint very short, fourth joint rather short, thence distad the joints are moniliform, longitudinal, regularly increasing in length; dorsal surface of the head with the usual sulci subobsolete, caudal margin faintly emarginate mesad. Pronotum with greatest length subequal to median width, cephalic margin truncate, cephalo-lateral angles narrowly rounded, lateral margins straight and regularly diverging caudad, caudo-lateral angles well rounded, caudal margin considerably arcuate, lateral margins finely cingulate; a delicate medio-longitudinal line is finely impressed cephalad and faintly elevated caudad. Tegmina slightly shorter than the pronotum; strongly and continuously cingulo-carinate at the lateral bend; sutural margins straight, attingent; distal margin obliquely arcuato-truncate, the slope of the same directed laterad. No exposed wings. Abdomen faintly fusiform, the second and third dorsal segments with poorly defined lateral folds; disto-dorsal segment transverse, its greatest width more than twice its greatest length, lateral margins of same subparallel, distal margin shallowly arcuato-emarginate at the base of each arm of the forceps, shallowly arcuato-emarginate dorsad of the base of the pygidium, a distinct L-shaped impressed area present mesad and not quite touching the caudal margin; forceps heavy, symmetrical, slightly shorter than the abdomen, proximal two-thirds of the arms straight, distal third gently arcuate inward, the extreme apex faintly hooked, the internal margin at five-eighths the length from the base with a short but distinct tooth, proximad of which there is a continuous though narrow projection of the margin, moderately arcuate with several very fine serrulations; process of the pygidium almost half as long as the abdomen, linguiform, faintly narrowing from the base to the middle, then faintly expanding again distad to the apex, which latter is obtuse-angulate emarginate; disto-ventral segment transverse, free margin arcuate with a very shallow V emargination mesad. Limbs rather short; femora moderately robust.

*Allotype.*— ♀ ; Same data as type.

Differing from the description of the type chiefly in the features here given. Disto-dorsal abdominal segment with distal margin truncate mesad and faintly oblique truncate at base of forceps; forceps much lighter in build than those of the male, little more than half as long as the abdomen, triquetrous in proximal section, regularly attenuate from base, nearly straight in basal half, gently bending inwards in distal half with the extreme apex as in the male, the arms of the forceps well crossed, internal margins of forceps sublamellate proximad with several distinct serrations; pygidium tucked between the forceps; disto-ventral abdominal segment with the free margin well arcuate with a faint median angulation.

General color blackish brown with a touch of maroon on the abdominal segments, the translucent lateral margins of the pronotum showing up dark honey yellow. Mouth parts clay color; antennae verona brown; limbs mikado brown; forceps and pygidial process kaiser brown.

*Measurements (in millimeters)*

| | ♂ (*type*) | ♀ (*allotype*) |
|---|---|---|
| Length of body (exclusive of the forceps), | 9.5 | 10 |
| Length of pronotum, | 1.9 | 1.9 |
| Length of tegmen, | 1.5 | 1.6 |
| Length of forceps, | 4.2 | 3.2 |
| Length of pygidial process, | 1.6 | |

In addition to the type and allotype we have examined three paratypic females bearing the same data as the type.

We take pleasure in dedicating this striking species to the illustrious Brazilian zoologist Dr. Herman Von Ihering, to whose kindness we owe the opportunity to study the present collection.

**Sparatta clarkii** Kirby

1896. *Sparatta clarkii* Kirby, Journ. Linn. Soc. London, Zool., xxv, p. 526, pl. xx, figs. 8, 8a. [Tejuca, Petropolis, Constancia and Theresopolis, Brazil.]

Hamonia, State of Santa Catharina. June 12. (Lüderwaldt; under bark of tree.) One male, two females, one immature male, one immature female.

We are using this name tentatively, as we are not convinced of the distinctness of this form from Serville's *pelvimetra*. The present male material differs from the description of Serville's species in the uniformly black head, pronotum, tegmina and exposed portion of wings, but what value should be attached to this difference is uncertain. The females are representative of the form called *pygidiata* by Kirby, which Burr has suggested as a probable synonym of *clarkii*. We are quite certain the latter view is correct. The adult females agree with the male in coloration. What relationship *clarkii* has to *rufina* Stål we do not know, but here again there is strong probability of more synonymy. Stål does not mention the medio-internal tooth on the forceps, but this may have been a pure oversight. The male specimen has the left branch of the forceps imperfect.

**Parasparatta nigrina** (Stål)

1855. *S[paratta] nigrina* Stål, Öfv. Kongl. Vetensk. Akad. Förh., xii, p. 350. [Rio de Janeiro, Brazil.]

Hamonia, State of Santa Catharina. August, 1910. (Lüderwaldt; under bark of tree.) One male, one female.

### Forficulidae

**Doru lineare** (Eschscholtz)

1822. *Forficula linearis* Eschscholtz, Entomographien, p. 81. [Santa Catharina, Brazil.]

São Paulo, State of São Paulo. February 1; garden field. Two males.

These specimens are true *lineare* in the relative length of the pygidial spine and the curve of the branches of the forceps when seen in lateral aspect, but the wings do not extend distad of the tegmina, in this resembling the North American *aculeatum*. This is the first demonstration we have had of the presence of intraspecific wing dimorphism, such as we find in *Psalis* and *Labidura*, in this genus. In consequence the key to certain species of this genus recently published by Rehn and Hebard[3] will require some modification, the presence or absence of exposed portions of the wings not being a valid diagnostic character and therefore it should be eliminated from the key. The other features given are, however, of prime importance.

**Doru luteipenne** (Serville)

1839. *Forficula luteipennis* Serville, Hist. Nat. Ins., Orthopt., p. 46. [Brazil.]

Piassaguéra, State of São Paulo. October, 1910. (H. Lüderwaldt.) Two males.

This is the first opportunity we have had to examine this striking species, which has generally been considered to be a synonym or but a variety of *lineare*. It is in fact a very distinct species, separated from *lineare* and *aculeatum* by the heavier sculpture of the abdomen, particularly of the disto-dorsal segment of the same, and by the elongate limbs, the tarsi, especially, being much more elongate. In addition, the position of the tooth on the internal margin of the male forceps is median instead of distad as in *lineare*.

## ORTHOPTERA

### Blattidae

**Ischnoptera brasiliensis** Brunner

1865. *I[schnoptera] brasiliensis* Brunner, Nouv. Syst. Blatt., p. 131, pl. iii, figs. 12a–c. [Brazil.]

[3] Journ. N. Y. Entom. Soc., xxii, pp. 89 to 90, (1914).

Ypiranga, State of São Paulo. June, 1908. (H. Lüderwaldt.) One male.

**Ischnoptera mexicana** Saussure?

1862. *I[schnoptera] mexicana* Saussure, Révue et Magasin de Zoologie, 2e ser., xiv, p. 170. [Tropical Mexico.]

Ypiranga, State of São Paulo. October, 1912. (H. Lüderwaldt.) One female.

We refer this specimen doubtfully to *mexicana*, a species which has not been recorded so far to the southward. The present specimen, however, agrees with all but several very minor features of Saussure's description, and, without material of unquestioned *mexicana* for comparison, the best course appears to be to treat it in the present fashion. Actual comparison may show unmentioned characters worthy of specific value and necessitate the separation of the present insect from the more northern type.

**Neoblattella fasciata** (Brunner)

1865. *Ph[yllodromia] fasciata* Brunner, Nouv. Syst. Blatt., p. 107. [Brazil.]

Castro, State of Paraná. 1907. (E. Garbe.) One female.

This species is closely related to *N. conspersa* (Brunner) of eastern and northeastern Brazil, which it probably represents in the southern part of the country. It is easily recognized by its distinctive livery. The present record is the first one known to us with an exact locality.

**Epilampra caliginosa** Walker

1868. *Epilampra caliginosa* Walker, Catal. Blatt. Brit. Mus., p. 207. [Tejuca, Brazil.]

São Paulo, State of São Paulo. February 8, 1906. One female.

This apparently is but the second record of the species. It has considerable resemblance to *E. agathina* (Saussure) from the same general region, but it is smaller, with a differently shaped pronotum and somewhat different pattern. The pale proximal antennal joint is sharply contrasted with the blackish of the remainder of the antennae. As the female of this species was previously unknown, the measurements of that sex may be of interest: length of body, 29.5 mm.; length of pronotum, 7; greatest width of pronotum, 8.7; length of tegmen, 27; greatest width of tegmen, 8.6.

**Tribonium spectrum** (Eschscholtz)

1822. *Blatta spectrum* Eschscholtz, Entomographien, p. 85. [Santa Catharina, Brazil.]

Ypiranga, State of São Paulo. October, 1912. (H. Lüderwaldt.) One male.

Santa Catharina. One male. [Hebard Cln.]

These records appear to be the first from Brazil with exact data since the original description.

**Chorisoneura personata** Rehn

1916. *Chorisoneura personata* Rehn, Trans. Amer. Entom. Soc., xlii, p. 249, pl. xv, fig. 31. [Independencia, state of Parahyba, Brazil.]

Bahia, State of Bahia. February 1. (Garden field.) One female.

This specimen while slightly larger than the type and paratypic individuals of the species is otherwise inseparable.

## Mantidae

**Acontiothespis concinna** (Perty)

1834. *Mantis concinna* Perty, Delect. Anim. Articulat. Brasil., p. 117, pl. 23, fig. 5. [Rio Negro, Brazil.]

Estação Alto do Serra, State of São Paulo. December, 1910. (E. Schwebel.) One male, one female.

Santos, State of São Paulo. August, 1910. (H. Lüderwaldt.) One female.

Saussure and Zehntner have definitely recorded this species from Rio de Janeiro, Caravelles and Bahia.

**Coptopteryx argentina** (Burmeister)

1864. *M[antis] argentina* Burmeister, Berl. Entom. Zeitschr., viii, p. 208. [Argentina between Buenos Aires and Mendoza.]

Porto Alegre, State of Rio Grande do Sul. June, 1912. (Dr. H. Lüdecke.) One female.

Apparently this is the first exact record of the species from Brazil, in but the extreme southern portion of which it occurs.

**Musoniella ipiranga** new species (Plate X, figs. 2 and 3.)

Apparently allied to *M. brasiliensis* Giglio-Tos, described from Matto Grosso, Brazil,[4] but differing in the markedly attenuate cephalic prozonal region, the more elongate tegmina, in the proximal infuscation of the transverse nervures of the tegmina, and

[4] Bull. Soc. Entom. Ital., xlvii, p. 5, (1916).

doubtless other features of difference not discussed in the rather unsatisfactory, merely diagnostic description of *brasiliensis*. From *argentina*, the genotype, and *chopardi*, the remaining species of the genus, both of which are now before us, the present species is immediately separable by its more elongate pronotum, which shows a tendency toward *Musonia*.

*Type*.—♂; Ypiranga, State of São Paulo, Brazil. February, 1913. (H. Lüderwaldt.) [Acad. Nat. Sci. Phila., Type no. 5271.]

Size medium (for the genus): form elongate, slender. Head broad, the greatest width across the eyes equal to one and one-half times the supra-coxal width of the pronotum, the greatest depth of the head contained one and three-eighths times in the greatest width of the same; occipital line transverse subtruncate between the juxta-ocular sulci, which are well indicated and distinctly separate the rounded obtuse juxta-ocular lobes from the occiput proper, juxta-ocular sulci following the curve of the internal margins of the eyes and converging ventrad; ocelli large, prominent, placed in a triangle which is slightly deeper than broad; facial shield strongly transverse, its greatest depth contained two and one-half times in the greatest width, dorsal margin obtuse-angulate, the dorso-lateral angles rectangulate, the lateral margins slightly converging ventrad, the ventral margin faintly arcuato-emarginate, the surface of the plate subimpressed: eyes subglobose when seen from the dorsum, full and reniform in shape when seen from the cephalic aspect, in basal outline broad ovoid: antennae about two-thirds as long as the body, the articles moniliform, particularly distad. Pronotum moderately elongate, the greatest width across the supra-coxal expansion contained three times in the greatest length of the same; collar narrowing cephalad, the distal extremity rather narrowly rounded, the expansions very weak, rounded, shaft subequal in width, appreciably broader than the collar; lateral margins finely and rather distantly serrulate; shaft one and one-half times as long as the collar; medio-longitudinal carina distinct but not high, sub-obsolete cephalad; transverse impression arcuate, oblique lateral impressions on the collar distinct. Tegmina when in repose slightly surpassing the apex of the subgenital plate, broad, the greatest width, which is at the distal fourth, contained nearly four times in the greatest length of the tegmen; costal margin appreciably arcuate briefly proximad and distad, the apex rounded sub-acute: marginal field narrow; numerous cross nervures in the discoidal field with distinct thickening at their juncture with the main veins. Wings, when in repose, surpassing the apices of the tegmina by about two millimeters, the greatest width slightly less than one-half the length of the wing; costal margin straight except for a brief but distinct arcuation distad, where the margin rounds to the broadly rounded acute apex: ulnar vein biramose; transverse nervures in the vicinity of the humeral trunk and of the ulnar vein thickened as in the tegmina. Form of the supra-anal plate not clearly definable, in general transverse; cerci incomplete; subgenital plate

slightly transverse, broad scoop-shaped, the lateral margins converging distad to the base of the styles, which are simple, styliform, acute processes, parallel in disposition and with the margin between their bases weakly arcuate, the length of the styles but slightly less than half the length of the plate. Cephalic limbs moderately slender: cephalic coxae but slightly shorter than the pronotum; cephalic femora slightly longer than the pronotum, weakly compressed, the greatest depth of the femur contained about four and one-half times in the length of the same; discoidal spines four in number; external margin with five to six spines, of which the distal one is on the genicular lobe; internal margin with twelve spines, alternating large and small: cephalic tibiae (exclusive of the apical claw) two-fifths as long as the femora, straight, armed on the external margin with five spines, proximad of which is a considerable unarmed diastema, internal margin armed with ten spines, these increasing in size distad; cephalic tarsi with the metatarsi slightly longer than the tibiae, remainder of the tarsal joints together slightly longer than the metatarsi. Median and caudal limbs very slender and elongate, the median femora slightly longer than the length of the head and pronotum combined, the caudal femora when extended caudad slightly surpassing the apex of the abdomen, caudal metatarsi three-fourths as long as the pronotum, the remaining joints of the caudal tarsi not more than three-fifths as long as the metatarsus.

General color mummy brown on the head, russet on the thorax and limbs, passing into sayal brown on the abdomen, the tegmina and wings faintly washed with snuff brown. Ocelli deep, clear bay; eyes fuscous mottled with raw umber; eyes brussels brown, darkening distad. Pronotum weakly vermiculate with fuscous. Tegmina with the cross veins of the discoidal field and in the vicinity of the humeral trunk with the section adjacent to the main veins briefly lined with fuscous. Wings with the humeral trunk, the ulnar, axillary and anal veins with the cross veins in their vicinity lined as on the tegmina.

Length of body, 26 mm.; length of pronotum, 6; greatest width of pronotum, 1.9; length of tegmen, 21; greatest width of tegmen, 5.4; length of cephalic femur, 6; length of caudal femur, 10.

The type of this species is unique.

**Stagmatoptera precaria** (Linnaeus)

1758. [*Gryllus* (*Mantis*)] *precaria* Linnaeus, Syst. Nat., X ed., i, p. 426. ["America; Africa."]

Salto Grande, State of São Paulo. February, 1911. (H. Lüderwaldt.) One male.

This specimen is inseparable from the Misiones, Argentina male previously recorded by us,[5] except that the tegmina and wings do not surpass the apex of the abdomen by more than a few millimeters, instead of by nearly half the pronotal length as in the other individual.

[5] Proc. Acad. Nat. Sci. Phila., 1913, p. 293, (1913).

## Phasmidae

**Paraphasma paulense** new species (Plate X, figs. 4 and 5.)

Apparently allied to *P. quadratum* (Bates), from Tapajos, Brazil, agreeing in the relatively long (for the genus) tegmina, but differing in the non-emarginate subgenital plate, the longer mesosternum and tegmina, although the body is of similar size, and in the generally blackish fuscous coloration with greenish venation and greenish points scattered along the tegminal veins.

*Type.*—♂; Cantareira, State of São Paulo, Brazil. February, 1914. (E. Garbe.) [Acad. Nat. Sci. Phila., Type no. 5347.]

Size medium; form moderately elongate; surface in general smooth. Head short, moderately broad, its greatest length faintly greater than the width across eyes; caudal portion of head slightly narrowing caudad of the eyes; ocelli well indicated, placed in a triangle; eyes prominent, slightly flattened subglobose when seen from the dorsum, nearly circular in basal outline; antennae slightly surpassing the apex of the abdomen when extended caudad, relatively heavy, segments, aside from the proximal few, very elongate. Pronotum very slightly shorter than the head, rectangulate, moderately longitudinal, the greatest width contained about one and one-half times in the length; cephalic margin arcuate-emarginate, caudal margin truncate, lateral margins weakly sigmoid; transverse impression arcuate, the curve caudad, median carina obsolete. Mesonotum one and one-half times as long as the pronotum, subequal in width except in the supra-coxal section, the general width contained about two and one-half times in the greatest length of the mesonotum, the surface with paired areas of subobsolete and rounded granulations, which have a generally longitudinal disposition. Tegmina elongate (for the group), in length equal to that of the pro- and mesonotum combined, in form acute elongate-elliptical, its greatest width (when normally arched) contained about twice in the length of the tegmen; margins regular except that the sutural margin near the spine is somewhat ampliate, more so on the left than on the right tegmen; apex rounded acute; spine produced, acute, directed laterad; venation prominent. Wings reaching to the apex of the sixth abdominal segment, when expanded broad, the width faintly greater than one-half the length of the wing; apex of the wings rounded rectangulate. Ventral surface of the head, prosternum, mesosternum and metasternum with a distinct, moderately continuous sulcus, which broadens out on the mesosternum into a concavity involving the whole plate; abdomen moderately depressed, the segments of moderate length; seventh dorsal abdominal segment somewhat broadened, with a distinct medio-longitudinal carination; eighth dorsal segment slightly shorter than the seventh segment, narrowing distad, the dorsal surface carinate, the distal margin with a broad, median, V-shaped emargination; ninth dorsal segment faintly shorter than the eighth segment, moderately

compressed and sub-rostrate, the distal margin truncate, faintly oblique, when seen from the side, the disto-ventral angle thickened and bent inwards, that region and the internal surface of the whole distal margin covered with sub-imbricated, shagreenous denticulations; cerci about as long as the ninth dorsal abdominal segment, simple, relatively thick, slightly inbent, tips blunt: subgenital opercule short, transverse, regularly arcuate, non-emarginate. Cephalic femora in length nearly equal to the combined length of the pronotum, mesonotum and tegmina, slender, cephalic flexure moderately indicated, occupying about two-fifths of the femoral length, carinations low; cephalic tibiae in length surpassing the femora by about two-thirds the length of the pronotum. Median femora short, faintly shorter than the combined length of the pronotum and mesonotum; median tibiae subequal to the femora in length. Caudal femora reaching to the distal portion of the third abdominal segment; caudal tibiae subequal to the femora in length; caudal metatarsi about one-third as long as the tibiae, subequal to the remainder of the tarsal joints united.

General color mummy brown, becoming blackish fuscous on the prothorax and head, on the venter of the abdomen largely russet. Head with the post-ocular region bearing a single median and five lateral pairs of regularly distributed fine lines of tawny-olive, these represented on the pronotum by three lines and lateral blotches cephalad; eyes dresden brown blotched with dark chestnut brown; antennae blackish fuscous, the dorsal surface proximad weakly tawny-olive. Mesonotum with the lateral carinae and the granulations frosted with tawny-olive. Tegmina with the venation almost entirely lined with mignonette green, the spine blackish fuscous. Wings with the anterior field crossed obliquely by a cloud of poorly-defined ecru-olive, the whole anterior field with faint intimations of similar, but smaller, cloudings; posterior field of the wings infumate with bister. Abdomen with the dorsal surface clouded with bister. Femora with the carinae more or less distinctly lined with ecru-olive, the tibiae with but faint indications of the same; genicular extremities of the femora narrowly bordered with the same.

Length of body, 45.3 mm.; length of head, 3.5; length of pronotum, 2.7; length of mesonotum, 5; length of tegmen, 8; length of wing, 33; length of cephalic femur, 13.2; length of median femur, 7; length of caudal femur, 11.8.

The type is unique.

## ACRIDIDAE

### ACRYDIINAE

**Tettigidea multicostata** (Bolivar)

1887. *T[ettigidea] multicostata* Bolivar, Ann. Soc. Entom. Belg., xxxi, p. 299. [Brazil.]

Estação Alto do Serra, State of São Paulo. January, 1909. (E. Schwebel.) One female.

PROSCOPINAE

**Tetanorhynchus sublaevis** Brunner

1890. *Tetanorhynchus sublaevis* Brunner, Verhandl. k.-k. zool.-botan. Gesell. Wien, xl, p. 105, pl. iv, figs. 5a to 5c. [Theresopolis, State of Santa Catharina, Brazil.]

Piquete, State of São Paulo. One male.

This specimen has the postocular section of the head slightly longer in proportion than in the male figured by Brunner, but as there is some variation in this respect in allied species we prefer to consider it an individual feature.

**Cephalocoema costulata** Burmeister

1880. *Cephalocoema costulata* Burmeister, Abhandl. Naturforsch. Gesell., Halle, xv, heft 1, p. 9, pl. 1, figs. 5 to 7. [Argentina.]

Porto Alegre, State of Rio Grande do Sul. 1912. (P. P. Buck.) Three males, one female.

São Paulo, State of São Paulo. February 8, 1906: garden field; open woods. One male, one female.

Ypiranga, State of São Paulo. February, 1913. (H. Lüderwaldt.) One female.

These specimens all have the rostrum longer than material of both sexes from Cordoba and Carcaraña, Argentina, and males from Sapucay, Paraguay and Misiones, Argentina; females from the latter localities, however, agree with the Brazilian material in the relative length of this portion. Owing to the uncertain definition of a number of supposedly distinct species, i. e. *costulata*, *calamus*, *multispinosa* and *burmeisteri*, we prefer, for the present at least, to call the specimens recorded above, *costulata*. The differences given for these species may be racial, environmental or genetic, but we have not sufficient material or information to hazard an explanation along any one of these lines. We have already called attention to the variation found in the number of caudal tibial spines in this species.[6]

ACRIDINAE

(Truxalinae of most authors)

**Hyalopteryx asinus** Rehn

1906. *Hyalopteryx asinus* Rehn, Proc. Acad. Nat. Sci. Phila., 1906, p. 12, figs. 1 to 4. [São Paulo and Jundiahy, State of São Paulo, Brazil.]

França, State of São Paulo. January, 1911. (E. Garbe.) One female.

[6] Proc. Acad. Nat. Sci. Phila., 1907, p. 166, (1907).

This specimen is inseparable from the allotype (♀) of *asinus*, now before us. The size is, however, very slightly greater.

**Hyalopteryx rufipennis** Charpentier

1845. *Hyalopteryx rufipennis* Charpentier, Orthopt. Descr. et Depict., tab. 46. [Brazil.]

Paraná. (E. D. Jones.) Two males. [U. S. Nat. Mus.]

São Paulo, State of São Paulo. (Hempel.) One male. [Scudder Collection.]

These specimens are typical of the species, and apparently these are the first exact records of it from eastern Brazil.

**Truxalis brevicornis** (Johannson)

1764. *Gryllus brevicornis* Johannson, Amoen. Acad., vi, p. 398. [North America (Pennsylvania).]

Itatiba, State of São Paulo. April, 1910. (J. Lima.) One male.

**Orphula pagana** (Stål)

1860. *Gomphocerus* (*Hyalopteryx*) *paganus* Stål, Kong. Svenska Freg. Eugenies Resa, Zool., i, Ins., p. 339. [Rio Janeiro, Brazil.]

Itatiba, State of São Paulo. April, 1910. (J. Lima.) Two males, two females.

Estaçao Alto do Serra, State of São Paulo. January, 1909. (E. Schwebel.) Two males, one immature male.

We have straightened out the relationship and correct identity of this species in a recent paper.[7] The species, as *Orphulina veteratoria*, has been recorded from the vicinity of São Paulo, taken in the month of September.

**Orphulina veteratoria** Rehn

1906. *Orphulina veteratoria* Rehn, Proc. Acad. Nat. Sci. Phila., 1906, p. 21, figs. 5 and 6. (In part: female only.) [São Paulo, Brazil.]

1906. *Orphulina ocuta* Rehn, Ibid., p. 23, figs. 7 and 8. [São Paulo, Brazil.]

As we have shown elsewhere,[8] the male of *veteratoria* equals *Orphula pagana*, then unrecognized, while the female, which at the time of description we felt might not represent the same species as the male, is the same as our *acuta*. As we stated, in the paper referred to, that in case the two sexes proved to be

[7] Trans. Amer. Entom. Soc., xliii, p. 344, (1917).

[8] Trans. Amer. Entom. Soc., xliii, p. 344, (1917).

different species we "would restrict the name *veteratoria* to the ♀," that sex must be considered the restricted type and *veteratoria* in consequence replaces the name *acuta*, over which it has page priority.

**Orphulella punctata** (DeGeer)

1773. *Acrydium punctatum* DeGeer, Mém. Hist. Ins., iii, p. 503, pl. 42, fig. 12. [Surinam.]

Itatiba, State of São Paulo. April, 1910. (J. Lima.) Five males, seven females.

**Amblytropidia ferruginosa** Stål

1873. *A[mblytropidia] ferruginosa* Stål, Recens. Orthopt., I, p. 107. [Brazil

França, State of São Paulo. January, 1911. (E. Garbe.) One female.

This specimen agrees very fully with Stål's description of the fastigium, face, frontal costa, pronotum and tegminal form of his species, but is five millimeters longer and the antennae are no longer than the head and pronotum together. The differences in the specimen appear to us to be purely individual, particularly as there is as much size variation in a series of the allied *A. robusta*. The strongly impresso-punctate pronotal dorsum and subfoveolate face, as well as the transverse rugosity of the fastigium, appear to be characteristic of the species.

Bruner has recorded this species from Chapada, State of Matto Grosso.

**Fenestra bohlsii** Giglio-Tos

1895. *Fenestra bohlsii* Giglio-Tos, Zoolog. Jahrb., Abth. für Syŝtem., viii, p. 807. [Paraguay.]

França, State of São Paulo. January, 1911. (E. Garbe.) One female.

This specimen is inseparable from individuals from Misiones, Argentina and Sapucay, Paraguay. This is the extreme northeastern point from which the species is known. Northwestward it extends to Santa Cruz de la Sierra, Bolivia.

**Scyllina instabilis** Rehn

1906. *Scyllina instabilis* Rehn, Proc. Acad. Nat. Sci. Phila., 1906, p. 42, figs. 14 and 15. [São Paulo, Brazil.]

Estaçao Campo Grande, State of São Paulo. July, 1902. (M. Wacket.) One male.

**Scyllina brasiliensis** (Bruner)

1904. [*Pleetrotettix*] *brasiliensis* Bruner, Biol. Cent.-Amer., Orth., ii, p. 100. [Southern Brazil.]

Estaçao Campo Grande, State of São Paulo. July, 1902. (M. Wacket.) One female.

OMMEXECHINAE

**Ommexecha germari** Burmeister

1838. *O[mmexecha] germari* Burmeister, Handb. der Entom., ii, abth. ii, pt. i, p. 655. [Brazil.]

Salto Grande, State of São Paulo. February, 1911. (H. Lüderwaldt.) One female.

This is the most northern definite locality in Brazil from which the species is known.

**Ommexecha servillei** Blanchard

1837. *Ommexecha servillei* Blanchard, Ann. Soc. Entom. France, v, p. 613, pl. xxii, figs. 2 and 3. [Province of Corrientes, Argentina.]

Salto Grande, State of São Paulo. February, 1911. (H. Lüderwaldt.) One male.

Itatiba, State of São Paulo. April, 1910. (J. Lima.) One male, one female, one immature male.

These specimens are in the brown phase. The species has been reported from as far northeastward as Rio de Janeiro.

**Spathalium helios**[9] new species (Plate X, figs. 6 and 7.)

Apparently quite distinct from the other forms of the genus, being characterized by the great elevation of the prozonal section of the pronotal disk, the acute spiniform projections of the caudal margin of the pronotal disk and the strongly serrate character of the dorsal carina of the caudal femora. The strigose elevations of the metazonal disk are similar to those found in *S. hispidum*, but the other features given above are sharply differential.

*Type.*— ♀ ; França, State of São Paulo, Brazil. January, 1911. (E. Garbe.) [Acad. of Nat. Sciences Phila., Type no. 5278.]

Size medium: general form as usual in the genus: surface of head, pronotum and limbs rugose to tuberculate. Head with the occiput moderately ascending cephalad; interocular section of the vertex very broad, equal to twice the depth

[9] From Ἥλιος, the sun, in allusion to the radiating points on the caudal margin of the pronotal disk.

of the eye, with a pair of transverse ridges, the caudal of which has high lateral spiniform and lower median paired tubercles; fastigium strongly compressed, sulcate, moderately declivent, the usual interantennal projection distinct but not strong; frontal costa sulcate, slightly wider for a distance ventrad of the median ocellus than dorsad of the same, the ventral half of the ventro-ocellar section again widened and the immediately ventral portion sharply expanding, lateral carinae of the frontal costa developed into a pair of low, subspiniform lobes half way between the ocellus and the clypeal suture; genae roughened with a vertical obtuse-angulate impression; eyes globose, projecting, subcircular in basal outline; antennae depressed. Pronotum of the type found in nearly all of the species of this genus (i. e. all excepting *S. klugii*), the greatest width of the dorsum of the metazona subequal to the greatest length of the pronotal disk; cephalic margin of disk very weakly arcuate; caudal margin roughly arcuate; the cephalic margin unarmed; the caudal margin with three pairs of acute spiniform processes, the median pair quite long and all disposed at right angles to the margin proper; lateral carinae strongly indicated caudad of the median sulcus, sublamellate, serrato-dentate, produced laterad; surface of disk strongly scabrous, the lines of acute tubercles on the metazona radiating caudad and laterad; median carina caudad to the median sulcus elevated into a greatly inflated crest, which in height is nearly equal to the depth of the lateral lobes of the pronotum, when seen from the side this is roughly rounded in outline, slightly overhanging cephalad and caudad, and with its margin divided into three sections by irregular emarginations, lateral faces of this inflation covered with spiniform tubercles, median carina on the metazona subobsolete; lateral lobes of the pronotum with the greatest dorsal length very slightly greater than the greatest depth; cephalic margin of the lobes very weakly obtuse-angulate, ventro-cephalic angle nearly rectangulate, ventral margin sinuato-truncate, moderately oblique, ventro-caudal angle rectangulate, weakly produced, caudal margin somewhat oblique, nearly straight; surface of lateral lobes rugoso-tuberculate, these structures becoming linear in disposition caudad and there produced into spiniform projections, which, to the number of three or more, are strongly developed, near the cephalic margin of the lobes is present a median spiniform tubercle. Tegmina falling short of the apex of the abdomen, in fact not reaching the femoral apices, in length being hardly twice as long as the median line of the pronotal disk, lanceolate; marginal field moderately expanded at proximal third, narrowing distad; costal margin straight from the point of greatest width of marginal field to near the apex, where it is gently arcuate; sutural margin in general straight; apical margin acute with the immediate apex very narrowly rounded; texture of tegmina and arcolation of the same as in the other species of the genus. Wings reduced, when in repose but slightly surpassing the middle of the tegmina. Prosternum with the projection of the cephalic margin erect, subspiniform, deplanate on the cephalic face; interspace between mesosternal lobes strongly transverse, shallow, the greatest width over twice as great as the greatest depth, lobes broadly rounded; interspace between the metasternal lobes distinctly greater than that between the mesosternal lobes, very shallow, the lobes rotundato-rectangulate, cephalic

margin of interspace arcuate. Ovipositor valves moderately compressed. Median femora with the ventral margin sublamellate and sinuate, the distal extremity of the femur much heavier than the proximal portion, cephalic and dorsal faces subcarinate. Caudal femora but slightly shorter than the tegmina, moderately compressed, dorsal margin with distinct serrate projections inclined distad; dorso-external carina with a similar median projection and proximad and distad other smaller but similar points, ventro-external carina with a median pair of serrate projections; external pagina with a close, impressed, sub-imbricate pattern of chevron-shaped figures; dorso-median and lateral genicular lobes produced, narrow: caudal tibiae robust, armed on the external margin with nine spines; caudal metatarsus slightly longer than the second and third tarsal joints together.

General color verona brown, paling to sayal brown on the pronotum, with certain pale areas on the lateral lobes of the pronotum and caudal femora, clay color. Eyes buckthorn brown, antennae of the general color. Pronotum with scattered lines of blackish on certain of the points; lateral lobes of pronotum with an irregularly indicated pale area ventro-caudad. Tegmina weakly lineate with bone brown along the principal veins and marmorate with the same in the median area of the tegmina, as commonly found in the genus, also distinctly painted with the same color on the rami of the disto-sutural section. Wings washed with blackish. Abdomen mars brown. Limbs of the general color; caudal femora with three transverse pale areas, irregularly outlined, but subchevron-shaped on the external face, the distal pale area distinctly indicated on internal face alone.

Length of body, 30 mm.; length of pronotum, 9.2; greatest width of pronotal disk, 9.3; length of tegmen, 16.8; greatest width of tegmen, 5.2; length of caudal femur, 15.4.

The type of this striking species is unique.

**Parossa ampla** new species (Plate X, figs. 8 and 9.)

Allied to *P. bimaculata* (Giglio-Tos), but differing in the blunter caudal angle of the pronotal disk, in the broader tegmina (see plate X., figs. 9 and 10) which are subequal in width to the greatest dorsal pronotal width, in the apical region of the tegmina being much less acute and rounded at the extreme apex instead of acuminate as in *bimaculata,* and in the shorter and blunter ovipositor jaws.

*Type.*— ♀ ; França, State of São Paulo, Brazil. January, 1911. (E. Garbe.) [Acad. Nat. Sciences Phila., Type no. 5279.]

Size medium: form as usual in the genus: surface of the peculiar texture and with the usual vestiture found in the related *P. bimaculata.* Head as in *P. bimaculata.* Pronotum identical with that of *P. bimaculata* but with the caudal margin of the pronotal disk very broadly obtuse-angulate and hardly produced. Tegmina relatively broad, in greatest width subequal to the greatest caudal width of the pronotal disk; in length the tegmina surpass the apices of the

caudal femora by about the length of the pronotal disk: costal margin of the tegmina very faintly lobulate and subarcuate proximad, straight for the median three-fifths of the length, the distal extremity of this margin strongly arcuate to the narrowly rounded, but in general acute-angulate, apex, which is nearly sutural in position; sutural margin straight: reticulations of the tegmina fewer and more open than in *bimaculata*. Prosternal tubercle less elevated and less mamillate than in *bimaculata*. Ovipositor jaws shorter, more robust and less elongate than in *bimaculata*, the distal extremity of the dorsal valves more sharply upcurved, the ventral valves with the distal section more decurved. Limbs as in *bimaculata* but somewhat shorter; the caudal tarsi are also somewhat heavier.

*Allotype*.—♂; Same data as the type. [Acad. Nat. Sciences Phila.]

This sex differs from the male of *bimaculata* in the broader tegmina, which are slightly broader than the greatest (caudal) width of the pronotal disk; structure of the tegmina as in the type. Limbs agree with the description of the female.

General color lime green to light cress green, on the ventral surface and limbs passing to ecru olive or even old gold; tegmina washed in a tessellate pattern with pale green-yellow, the areas of the general color on the tegmina being relatively small, quadrate and evenly distributed. Usual spot at base of anal field of tegmina orange chrome. Wings with the veins of the anterior field washed with the general color, and of the remainder weakly lined with pale garnet brown. Eyes brussels brown (♀) to bay (♂). Antennae dull garnet brown. Caudal tibiae becoming more intense coral pink to light jasper red distad, the spines very narrowly black tipped. Vestiture whitish.

*Measurements (in millimeters)*

| | *P. ampla* | | *P. bimaculata* | |
|---|---|---|---|---|
| | ♂ (*allotype*) | ♀ (*type*) | ♂ (Sapucay, Paraguay) | ♀ (Sapucay, Paraguay) |
| Length of body, | 19.8 | 27.3 | 21.5 | 27.8 |
| Length of pronotum, | 5.4 | 6.7 | 5.3 | 7.3 |
| Greatest caudal width of pronotal disk, | 4 | 5 | 3.7 | 5.2 |
| Length of tegmen, | 20.3 | 24 | 21.4 | 27.3 |
| Greatest width of tegmen, | 4.1 | 4.6 | 3.4 | 4.5 |
| Length of caudal femur, | 12 | 13.5 | 12 | 15.5 |

In addition to the type and allotype we have examined a paratypic female.

LOCUSTINAE

**Procolpia emarginata** (Serville)

1832. *Xiphicera emarginata* Serville, Ann. Sci. Nat., xxii, p. 271. [Brazil.]

Estaçao Piassaguera, State of São Paulo. December, 1910. (H. Lüderwaldt.) One female.

Brazil (no exact data). One male.

We wish to re-affirm our previously expressed opinion that *Procolpia minor* Giglio-Tos is a member of this genus and not of the genus *Munatia*, as considered by Bruner. We have compared the species with both sexes of the genotypes of the genera involved and find every tendency toward *P. emarginata*, aside from the acuminate tips of the tegmina and wings. In this latter feature, however, we note as discernible the oblique sutural emargination of *Procolpia*, while the characters of the rostrum, pronotum, the general pronotal form, and character, texture and general form of the limbs are more nearly those of *P. emarginata*, the genotype of *Procolpia*.

**Diedronotus discoideus** (Serville)

1831. *Tropinotus discoideus* Serville, Ann. Sci. Nat., xxii, p. 273. [Brazil.]

Porto Alegre, State of Rio Grande do Sul. June, 1912. (H. Lüdecke.) One female.

Itatiba, State of São Paulo. April, 1910. (J. Lima.) Two males.

Salto Grande, State of São Paulo. February, 1911. (H. Lüderwaldt.) One male.

This species ranges to the southward into northern Argentina, but is definitely known from but little to the northward of the São Paulo records.

**Diedronotus regularis** (Bruner)

1905. *Tropinotus regularis* Bruner, Entom. News, xvi. p. 214. [Sapucay, Paraguay.]

França, State of São Paulo. January, 1911. (E. Garbe.) Two females.

This is the most eastern record of the species, which was previously known only from the type locality and Chapada, Matto Grosso.

**Elaeochlora viridicata** (Serville)

1839. *Xiphicera viridicata* Serville, Hist. Nat. Ins., Orth., p. 614. [Buenos Aires, Argentina.]

França, State of São Paulo. January, 1911. (E. Garbe.) One male.

Porto Alegre, State of Rio Grande do Sul. June, 1912. One male.

This Porto Alegre male is very similar to topotypic males, except that the size is somewhat less and the tegmina and wings do not surpass the femoral apices. The caudal tibiae, however, show no red in their yellowish ground color. The França male is more similar to specimens from Sapucay, Paraguay and the Misiones, Argentina, which have been the subject of comment by us.[10]

**Elaeochlora arcuata** Rehn

1908. *Elaeochlora arcuata* Rehn, Proc. Acad. Nat. Sci. Phila., 1908, p. 13, fig. 1. [Jundiahy, State of São Paulo, Brazil.]

Salto Grande, State of São Paulo. February, 1911. (H. Lüderwaldt.) One male.

When compared with the type (♂) this specimen has the fastigium acute-angulate, more deeply sulcate and depressed transversely proximad, the tegmina are slightly more elongate and narrower, and the limbs are all appreciably more elongate. This is, however, no question in our mind of the identity of the specimen with *arcuata*.

This species is known only from the two localities.

**Chromacris miles** (Drury)

1773. *Gryll[us] Loc[usta] miles* Drury, Illustr. Nat. Hist. Exot. Ins., ii, pp. 79 and Index, pl. xlii, fig. 2. [Bay of Honduras.]

Salto Grande, State of São Paulo. February, 1911. (H. Lüderwaldt.) One male.

França, State of São Paulo. January, 1911. (E. Garbe.) Two males, three females.

Porto Alegre, State of Rio Grande do Sul. June, 1912. Two females.

The Porto Alegre specimens have the pale markings orange rufous, as usual in the more southern individuals of the species; the Salto Grande individual has much more yellowish pale markings, while the França specimens have these markings decidedly yellow. In all the tegmina show a more or less distinct brick-red wash. The pale areas of the wings are brick-red in the Porto Alegre and Salto Grande specimens, a deeper and more intense red in the França representatives.

[10] Proc. Acad. Nat. Sci. Phila. 1907, p. 174; Ibid., 1913, p. 331.

**Zoniopoda tarsata** (Serville)

1831. *Acridium tarsata* Serville, Ann. Sci. Nat., xxii, p. 283. [Brazil.]

França, State of São Paulo. January, 1911. (E. Garbe.) One female.

This specimen is inseparable from other material of the species from several localities. The species has been definitely recorded from Rio de Janeiro and Jundiahy, State of São Paulo, as well as the State of Rio Grande do Sul, Brazil.

**Zoniopoda cruentata** (Blanchard)

1846. *Acridium cruentatum* Blanchard, in D'Orbigny. Voy. dans l'Amér. Merid., vi, pt. ii, p. 216, pl. xxvii, fig. 5. [No locality.]

Porto Alegre, State of Rio Grande do Sul. June, 1912. One female.

It appears probable that *cruentata* and *tarsata* are merely geographic races of the same species, or even only environmental phases, but more material from other localities is necessary to clearly demonstrate the real relationship of the two. Typically they appear distinct and the series show fair geographic correlation, the more reddish *tarsata* to Brazilian localities, the more yellowish *cruentata* to Paraguayan and Argentinian localities. The presence of material (one male and one female) from La Cumbre, Province of Cordoba, Argentina, nearer *tarsata* than *cruentata* suggests, however, the possibility of environmental, instead of purely geographic or regional, influences being responsible for the color differences. Material from a number of localities and habitat information must be available to clear up this problem.

**Zoniopoda hempeli** Bruner

1911. *Zoniopoda hempeli* Bruner, Ann. Carneg. Mus., viii, p. 58 footnote. [São Paulo, Brazil.]

França, State of São Paulo. January, 1911. (E. Garbe.) One female.

This specimen measures as follows: length of body, 36.5 mm.; length of pronotum, 9.2; length of tegmen, 31.7; length of caudal femur, 18.2. The species was previously known only from the original description, and in position it is very close to *iheringi* and *mimicula*.

**Zoniopoda similis** Bruner

1906. *Zoniopoda similis* Bruner, Proc. U. S. Nat. Mus., xxx, p. 652. [Sapucay, Paraguay.]

França, State of São Paulo. January, 1911. (E. Garbe.) Three males, three females.

These specimens are slightly smaller than a number of topotypes of both sexes now before us. The species is now known from the two localities given above and Chapada, Matto Grosso, Brazil.

**Prionacris erosa** Rehn

1907. *Prionacris erosa* Rehn, Proc. Acad. Nat. Sci. Phila., 1907, p. 176, figs. 10 and 11. [Sapucay, Paraguay.]

França, State of São Paulo. January, 1911. (E. Garbe.) One female.

This specimen is of almost the same dimensions as the female measured by Bruner.[11] The species is known only from the localities given above and Chapada, Matto Grosso, Brazil (Bruner).

**Diponthus crassus** Bruner

1910. *Diponthus crassus* Bruner, Entom. News, xxi, p. 303. [Puerto Bertoni, Paraguay.]

Porto Majoli, State of Paraná. October, 1910. (Schrottky.) One female.

This specimen is badly shrivelled and discolored, but is clearly referable to this species, of which we have a topotypic male. This is the first Brazilian record of the species.

**Leptysma filiformis** (Serville)

1839. *Opsomala filiformis* Serville, Hist. Nat. Ins., Orthopt., p. 593. [The North of the State of São Paulo, Brazil.]

Porto Alegre, State of Rio Grande do Sul. Two males.

**Stenacris cylindrodes** (Stål)

1860. *Opsomala cylindrodes* Stål, Kong. Svenska Freg. Eugenies Resa, Ins., p. 325. [Rio de Janeiro, Brazil.]

Porto Alegre, State of Rio Grande do Sul. June, 1912. One female.

This locality and Resistencia, Chaco, Argentina are the most southern localities from which the species is known.

[11] Ann. Carneg. Mus., viii, p. 62, (1911).

**Cornops**[12] **politum** (Bruner)

1906. *Paracornops politum* Bruner, Proc. U. S. Nat. Mus., xxx, pp. 662, 664. [Rio de Janeiro, Brazil.]

Ypiranga, State of São Paulo. April, 1910. (Lüderwaldt; at electric light.) One female.

This specimen is provisionally assigned here, as it has the tegmina longer in proportion than described, but our material of other species shows considerable individual variation occurs in this feature. When compared with *C. aquaticum*, with which Bruner compared this species, it is seen to be closely related, in fact *politum* may be merely a geographic race of *aquaticum*.

This specimen measures as follows: length of body, 27 mm.; length of pronotum, 5.6; greatest caudal width of pronotal disk, 3.9; length of tegmen, 26.2; length of caudal femur, 16.6.

**Cornops ignotum** new species (Plate X, figs. 11, 12 and 13.)

1906. *Paracornops longipenne* Bruner (not *Paracornops longipenne* (DeGeer)), Proc. U. S. Nat. Mus., xxx, p. 662. [São Paulo, Brazil.]

1908. *Paracornops longipenne* Rehn (not *Paracornops longipenne* (DeGeer)), Proc. Acad. Nat. Sci. Phila., 1908, p. 16. [São Paulo, Brazil.]

As we have shown elsewhere[13] DeGeer's *longipenne*, from Surinam, is a species quite distinct from this, in fact nearest to *C. longicorne* (Bruner). The present author followed Bruner in using the DeGeerian name for this species. As we have not seen the allied *C. paraguayense* (Bruner), we are unable to say how this species differs from that form, but the difference between this species (as *longipenne*) and *C. dorsatum* (Bruner) has been mentioned in the description of the latter.

*Type.*—♂; São Paulo, State of São Paulo, Brazil. September 14, 1900. [Acad. Nat. Sci. Phila., Type no. 5283.]

Size slightly above the average for the genus; form as usual in the genus: surface of face, ventro-cephalic section of genae, pronotum and pleura rather thickly and regularly impresso-punctate. Head with normally exposed dorsal section but slightly more than two-thirds of the dorsal length of the pronotum; occiput and fastigium nearly flat when seen from the lateral aspect: interocular space no wider than broadest section of frontal costa; fastigium rectangulate when seen from the dorsum, finely but distinctly medio-longitudinally sulcate, margins slightly elevated; fastigio-facial angle when seen from the lateral aspect slightly rounded subacute, facial line from interantennal region very

[12] We have elsewhere (Trans. Amer. Entom. Soc., xlii, pp. 285, 286, (1916) shown that *Paracornops* Giglio-Tos equals *Cornops* Scudder.

[13] Trans. Amer. Entom. Soc., xlii, pp. 286 & 287, (1916).

straight retreating; frontal costa moderately broad, considerably narrowed at the fastigio-facial angle, greatest breadth between the antennae, then very faintly narrowing ventrad, carinal margins of the costa almost reaching the clypeal sulcus, sulcus of costa extending from between the antennae ventrad for the full length, deep in the ocellar region, strongly punctate; supplementary facial carinae distinct, straight, moderately divergent ventrad: eyes moderately prominent, in length slightly more than that of the infra-ocular sulcus, in form ovate-reniform; antennae slightly longer than the combined length of the head and pronotum, rather heavy, proximad subdepressed. Pronotum subcylindrical, the greatest (caudal) width of disk contained about one and one-half times in the greatest dorsal length of the same; cephalic margin of disk arcuate with a shallow but evident median emargination; caudal margin arcuate obtuse-angulate; lateral shoulder rounded, although sub-evident on the metazona; median carina indicated although not clearly formed, and severed by three transverse sulci; lateral lobes longer than deep, ventral margin sub-truncate caudad, oblique subconcave cephalad, caudo-ventral angle broadly rounded. Tegmina elongate, surpassing the apex of the body by nearly the length of the head and pronotum, and of the caudal femora by almost the pronotal length; apex well rounded. Prosternal spine erect, subconical, blunted: interspace between the mesosternal lobes slightly longer than broad, slightly broader than a single lobe: metasternal lobes contiguous caudad. Supra-anal plate trigonal, faintly longer than proximal width, apex well rounded, cercal emargination of lateral margins of the plate distinct but not deep, rectangulate; proximal half of plate with a pair of median carinae, a latero-proximal tubercle and one at the cercal emargination, these as well as the paired carinae well elevated and black: cerci of the falcate type usual in the group, rather sharply bent falcate in form, the tip rather blunt, slightly incurved; subgenital plate strongly compressed, subrostrate disto-dorsad although little produced, distal face finely sulcate. Caudal femora about two-thirds as long as the body, moderately robust (for the genus), geniculer lobes distinctly and sharply acute-angulate; caudal tibiae with seven spines on the external margin and ten on the internal margin, the distal half of the tibiae considerably expanded and the margins appreciably lamellate, with the fringing brushes of scattered but long hairs; caudal tarsi with the metatarsus and third joint subequal in length.

Allotype.—♀; Same data as type. [Acad. Nat. Sci. Phila.]

Differing from the male description as given below. Interocular space slightly wider than the broadest section of the frontal costa; fastigium slightly more than a right angle when seen from the dorsum. Tegmina apparently slightly shorter than in the male (apices broken). Dorsal ovipositor jaws with six teeth on lateral margins. Caudal tibiae with six spines on external margin.

General coloration of dorsal surface brussels brown to raw umber, darkening laterad over the dark bars until they are sharply seal brown where they meet the straw yellow to light ochraceous-buff of the lower genae, lower lateral lobes and ventral section of pleura. Venter of body buckthorn brown. Eyes cinnamon-brown; antennae of the dorsal color; face pale dull bister to brownish olive.

Cephalic and median limbs dull tawny-olive, sometimes washed with greenish; caudal femora buckthorn brown to tawny; caudal tibiae bluish gray-green, on external face washed with the color of the femora, spines straw color, black tipped. Wings hyaline with fuscous veins, the latter whitish proximad.

*Measurements (in millimeters)*

| | ♂ (*type*) | ♂ (*paratype*) | ♀ (*allotype*) |
|---|---|---|---|
| Length of body, | 20 | 21.9 | 25.2 |
| Length of pronotum, | 4.3 | 4.6 | 5.6 |
| Greatest width of pronotum, | 2.6 | 3 | 3.4 |
| Length of tegmen, | 20 | 22 | 22 (imperfect) |
| Length of caudal femur, | 12.6 | 14 | 15.8 |

In addition to the type and allotype we have before us four male paratypes, taken the same date as the type. These specimens fully agree with the type in all important characters, although there is seen to be a great amount of individual size variation. One paratype is larger than the type and we have given its measurements above. The number of spines on the external margin of the caudal femora is seen to vary individually from six to seven.

**Cornops dorsatum** (Bruner)

1911. *Paracornops dorsatum* Bruner, Ann. Carneg. Mus., viii, p. 84. [Chapada, Matto Grosso, Brazil.]

Porto Majoli, State of Paraná. October to November, 1910. (Schrottky.) Two females.

This species is rather closely related to *C. ignotum*, but the differences are quite evident on close comparison.

The two localities given above are the only ones known for the species.

**Abracris chapadensis** (Bruner)

1908. *Omalotettix chapadensis* Bruner, Biol. Cent.-Amer., Orth., ii, pp. 280, 282. [Chapada, Matto Grosso, Brazil.]

França, State of São Paulo. January, 1911. (E. Garbe.) Two females.

The specimens are referred rather tentatively to this species, the only detailed description of which was based solely on a single male,[14] although both sexes were indicated in the key there presented.[15] At present we have males belonging to this species for

[14] Ann. Carneg. Mus., viii, p. 109, (1911).

[15] Ibid., p. 108.

examination. The species, as we understand it, is very close to *nebulosa*, from which it seems best separated by the shorter and broader fastigium, the less produced interantennal section of the frontal costa, the slightly greater interspace between the eyes, and the somewhat different shape of the ventral margin of the lateral lobes of the pronotum.

Of the series previously recorded by us, from Sapucay, Paraguay, as *signatipes*,[16] four females should be referred to the present form and the remainder to *coeruleipennis*. The confusion of this material was responsible for the comment there made on the variability of the coloration of the ventro-external face of the caudal femora. As we have shown elsewhere, however, almost as great a degree of variation in this respect is found in *coeruleipennis*. The specimen from Misiones, later reported by us as *nebulosa*,[17] was correctly associated, as an authentic pair loaned by Prof. Bruner shows.

**Osmilia violacea** (Thunberg)

1824. *Gr*[*yllus*] *violaceus* Thunberg, Mém. Acad. Imp. Sci. St. Pétersb., ix, p. 413. [Brazil.]

Piracicaba, State of São Paulo. November, 1906. (J. Lima.) One female.

This specimen is inseparable from Paraguayan and Misiones, Argentina material. We see no reason to separate Burmeister's *coelestre* from this species, or to replace Thunberg's name by the much later one. The distribution of this species appears to cover the region from eastern Peru and Ecuador, south through Bolivia and western Brazil to northern Argentina (Misiones, Jujuy, Tucuman and Chaco), east to the vicinity of Rio de Janeiro, Brazil. We have in addition records from Pará and Santarém, Brazil and Trinidad, but we suspect these may refer to specimens of *flavo-lineata* with a bluish green tint to the wing disks, such as we have recorded elsewhere from northeastern Brazil.[18]

[16] Proc. Acad. Nat. Sci. Phila., 1907, p. 187, (1907).
[17] Proc. Acad. Nat. Sci. Phila., 1913, p. 339, (1913).
[18] Trans. Amer. Entom. Soc., xlii, p. 295, (1916).

**Adimantus vitticeps** (Blanchard)

1846. *Acridium vitticeps* Blanchard, in D'Orbigny, Voy. dans l'Amér. Merid., vi, pt. ii, p. 216, pl. xxvii, fig. 4. [No locality cited.]

França, State of São Paulo. January, 1911. (E. Garbe.) One female.

This individual has the pale facial markings of the same brilliant yellow which colors similar portions of the pattern on the occiput, genae and pronotum, instead of a generally deadened greenish tone, as in the other specimens seen. The wings are pale greenish hyaline, with no trace of the blue said to be found in Burmeister's *ornatissimus*. The caudal tibiae are solid carmine, with the black annuli incomplete and indicated only on the ventral and lateral faces. The pinkish red of the ventral apex of the abdomen and the ventral valves of the ovipositor is decided.

**Zygoclistron trachystictum** Rehn

1905. *Zygoclistron trachystictum* Rehn, Entom. News, xvi, p. 39, figs. 1, 2 and 3. [Sapucay, Paraguay.]

França, State of São Paulo. January, 1911. (E. Garbe.) Five males, two females.

These specimens are inseparable from material from the type locality. All the França individuals are very much duller than the Sapucay representatives, the yellow being less brilliant and more ochraceous, the dorsal color less rufous and the lateral bars and the abdominal coloration more umber. The size is also slightly less than in the Sapucay representation.

This is the first Brazilian record of the species, which was previously known from Sapucay, Paraguay and Santa Cruz de la Sierra, Bolivia (Bruner).

**Homalosaparus canonicus** Rehn

1908. *Homalosaparus canonicus* Rehn, Proc. Acad. Nat. Sci. Phila., 1908, p. 17, figs. 2 and 3. [São Paulo, Brazil.]

Estaçao Campo Grande, State of São Paulo. July, 1912. One female.

**Schistocerca infumata** Scudder

1899. *Schistocerca infumata* Scudder, Proc. Amer. Acad. Arts and Sci., xxxiv, pp. 444, 457. [Montevideo, Uruguay; Brazil.]

Ypiranga, State of São Paulo. July, 1913. (H. Lüderwaldt.) One female.

**Dichroplus exilis** Giglio-Tos

1894. *D[ichroplus] exilis* Giglio-Tos, Boll. Mus. Zool. Anat. Comp. Torino, ix, no. 184, p. 23. [Resistencia, Chaco, Argentina.]

Itatiba, State of São Paulo. April, 1910. (J. Lima.) Two males, one female.

This is the most northeasterly record of the species, which ranges south to the provinces of Chaco and Jujuy, Argentina, and west to Santa Cruz de la Sierra, Bolivia.

**Dichroplus punctulatus** (Thunberg)

1824. *Gr[yllus] punctulatus* Thunberg, Mém. Acad. Imp. Sci. St. Pétersb., ix, p. 408. [Brazil.]

Itatiba, State of São Paulo. April, 1910. (J. Lima.) One male, one female.

São Paulo, State of São Paulo. February, 1905. (H. Lüderwaldt.) One female.

**Dichroplus bergii** (Stål)

1878. *P[ezotettix] bergii*. Stål, Bihang K. Svenska Vet.-Akad. Handl., v, no. 9, p. 6. ["Buenos Aires, Paraná, Corrientes, Argentina."]

State of São Paulo. (Hammer Cln.) One male, one female. [Cornell University.]

Itatiba, State of São Paulo. April, 1910. (J. Lima.) Five females.

Porto Alegre, State of Rio Grande do Sul. June, 1912. (H. Ludecke.) One female.

All of the specimens from the State of São Paulo have purplish caudal tibiae. The Porto Alegre individual has them much darker bluish purple with the internal face spotted with dull ochraceous proximad.

## Tettigoniidae

### Phaneropterinae

**Scaphura nitida** Perty

1834. *Scaphura nitida* Perty, in Spix and Martius, Delect. Anim. Artic. Brasil., p. 121, pl. xxiii, fig. 12. [Mountains of Minas Geraës, Brazil.]

São Paulo. One female. [M. C. Z.]

This specimen is fully typical of the species, which has also been recorded from Cayenne.

**Scaphura nigra** (Thunberg)

1824. *Gr[yllus] niger* Thunberg, Mém. Acad. Imp. Sci. St. Pétersb., ix, p. 415. [Brazil.]

França, State of São Paulo. January, 1911. (E. Garbe.) Two females.

These specimens are quite ochraceous-rufescent, the only chalybeous area being the dorsal and dorso-lateral sections of the abdomen. In one the distal section of the caudal femora and caudal tibiae are ochraceous, in the other blackish.

**Gymnocera lefebvrei** Brullé

"1835. *Gymnocera lefebvrei* Brullé, Hist. Nat. des Ins., ix, p. 146. [Brazil.]"

São Francisco, State of Santa Catharina. November 11, 1900. One male.

We have been unable to examine the original description of this species, but the present individual fully agrees with the descriptions of Serville and Brunner. It seems probable to us that *lefebvrei* and *fasciata*, of each of which we have a specimen before us, are phases or chromatomorphs of a single species, similar in this respect to the allied *Scaphura nigra*.

This is the first exact record of the occurrence of the species.

**Anaulacomera intermedia** Brunner

1878. *A[naulacomera] intermedia* Brunner, Monogr. der Phaneropt., pp. 278, 283. [Brazil.]

Santos, State of São Paulo. April 1, 1912. (H. Lüderwaldt.) One female.

This specimen fully agrees with the original description and with a male individual recorded by us elsewhere.[19] The vicinity of Rio de Janeiro and Santos are the only definite localities known for the species.

**Anaulacomera sulcata** Brunner

1878. *A[naulacomera] sulcata* Brunner, Monogr. der Phaneropt., pp. 279, 289. [Brazil; Peru.]

Ypiranga, State of São Paulo. February, 1913. (H. Lüderwaldt.) One male.

This species has been recorded from Goyaz, State of Goyaz, and Rio de Janeiro, Brazil.

[19] Trans. Am. Ent. Soc., xliii, p. 354, (1917).

**Grammadera janeirensis** Brunner

1915. *Grammadera janeirensis* Bruner, Ann. Carneg. Mus., ix, p. 321. [Rio de Janeiro, Brazil.]

São Paulo, State of São Paulo. February, 1907. (H. Lüderwaldt.) One male.

This specimen fully agrees with all the important features of the original description, but shows a slight sulcation of the dorsal surface of the fastigium, a condition described as present in the female but absent in the male. We find, however, some variation in the intensity of this sulcation in the allied *G. hastata* Brunner, and think that in the forms with elongate fastigia this feature varies, and probably geographically, but our material is too scanty to be positive of the character of the variation.

The two localities given above are all known for the species.

**Microcentrum lanceolatum** (Burmeister)

1838. *Ph[ylloptera] lanceolata* Burmeister, Handb. der Entom., ii, abth. ii, pt. i, p. 692. [Brazil.]

Porto Alegre, State of Rio Grande do Sul. June, 1912. (H. Lüdecke.) One female.

This is, apparently, the most southern record known for this widely distributed species.

**Microcentrum myrtifolium** Saussure and Pictet

1898. *Microcentrum myrtifolium* Saussure and Pictet, Biol. Cent.-Amer., Orth., i, p. 359. [Brazil.]

Ypiranga, State of São Paulo. October, 1910. (H. Lüderwaldt.) One female.

This specimen fully agrees with the original description and is, apparently, the first individual of the species with full locality to be recorded.

PSEUDOPHYLLINAE

**Meroncidius inornatus** Walker

1870. *Meroncidius inornatus* Walker, Catal. Dermapt. Salt. Brit. Mus., iii, p. 453. [Montevideo, Uruguay.]

São João de Barra, State of Rio de Janeiro. 1912. (E. Garbe.) One female.

This specimen agrees with Walker's description, vague though his remarks are as a whole. The species is apparently related to *M. intermedius* Brunner,[20] described from Rio de Janeiro, Theres-

[20] Monogr. der Pseudophyll., p. 150, pl. vi, fig. 66, (1895).

opolis, Canto Gallo and Bahia, Brazil, and Cayenne, in fact the two may be inseparable, although Brunner's species has a deeper ovipositor (5 instead of 4.5 mm.) and longer tegmina (47 instead of 39.6 mm.), while the other proportions are the same or very similar. The tegmina show small areas of fuscous at the sources of transverse nervures in the discoidal field, while in *intermedius* the tegmina are described as unicolorous. Further material will be necessary to show the proper relationship of the two names. Brunner, as usual, completely ignored the Walkerian species.

COPIPHORINAE

**Neoconocephalus irroratus** (Burmeister)

1838. *C[onocephalus] irroratus* Burmeister, Handb. der Entom., ii, abth. ii, pt. i, p. 705. [Brazil.]

Ypiranga, State of São Paulo. May, 1913. (Dr. H. Von Ihering.) One male.

The present specimen, which has been compared with Petropolis material, is in a decided brown phase of coloration, with the tegmina thickly mottled with fuscous.

The species has been recorded from a number of localities in southern Brazil.

**Neoconocephalus vicinus** Karny

1907. *Neoconocephalus vicinus* Karny, Abhandl. k.-k. zool.-botan. Gesell. Wien, iv, heft 3, pp. 26, 34. [Rio Grande do Sul (Brazil); Paraguay.]

França, State of São Paulo. January, 1911. (E. Garbe.) One female.

This specimen has been compared with material from Chapada, Matto Grosso, Brazil and Sapucay, Paraguay.

**Homorocoryphus kraussi** (Redtenbacher)

1891. *Conocephalus kraussi* Redtenbacher, Verhandl. k.-k. zool.-botan. Gesell. Wien, xli, pp. 384, 420. [Theresopolis and Rio Grande do Sul, Brazil.]

Porto Alegre, State of Rio Grande do Sul. June, 1912. One male.

**Bucrates lanista** new species (Plate X, figs. 14, 15, 16 and 17.)

Differing from the two other known species of the genus[21] in

[21] We have shown elsewhere (Trans. Amer. Entom. Soc., xliii, p. 116, (1917)) that *Bucrates cocanus* Bolivar was founded on the male sex of *Parabucrates brevicauda* (Scudder). Stoll's *Locusta falx* (Natuur. Afbeeld. Beschr. Spooken, etc., Zabel-en Trekspr., p. 28, pl. xiiia, fig. 54, reg. p. 11, (1813))

the following features. From *capitatus* (De Geer) in the slightly more compressed form, narrower and deeper fastigium, less inflated face and genae, in the eyes having their outline more truncate cephalad and less evenly circular, in the shorter pronotal disk, in the proportionately longer and more shallow lateral lobes of the pronotum, in the very elongate tegmina and wings, the much more slender caudal femora and in the more sharply angulate-emarginate subgenital plate of the female. From *clausus* (Scudder) the new species differs in the more robust form, in the shorter and broader face and mouth-parts, in the non-ascendent fastigium, in the subtruncate caudal margin of the pronotal disk, in the much longer and more shallow lateral lobes of the pronotum (these being distinctly deeper than long in *clausus*), in the finer tegminal texture, in the longer and more slender femora, the longer ovipositor and the deeply (instead of extremely weakly) angulate-emarginate female subgenital plate.

*Type.*— ♀ ; Porto Alegre, State of Rio Grande do Sul, Brazil. June, 1912. [Acad. Nat. Sci. Phila., Type no. 5324.]

Size large: form moderately robust (more slender than in *B. capitatus*, more robust than in *clausus*), elongate: surface of head and pronotum more or less finely punctate; tegmina closely punctato-reticulate proximad, becoming irregularly reticulate distad. Head with its exposed dorsal surface equal to twice the length of the dorsum of the pronotum; face distinctly retreating from dorsal surface of the fastigium to clypeal suture, three-fourths as long as the dorsum of the pronotum: fastigium broad, its greatest width slightly more than the greatest dimension of the eye, its greatest length hardly more than one-half its greatest width, distinctly but not greatly narrowed proximad, the cephalic outline, when seen from the dorsum, being arcuate obtuse-angulate; when seen from the side the fastigium is not elevated dorsad of the general line of the head; cephalic face of the fastigium slightly more acute than a right angle ventrad, the tip well in contact and imbedded in the fastigium of the face: eyes little prominent in basal outline, broad ovoid, the cephalic section of the outline appreciably oblique and flattened: antennae broken. Pronotum rotundato-deplanate dorsad, the greatest caudal width of the dorsum equal to two-thirds that of the greatest length of the same: cephalic margin of the disk faintly sinuato-truncate; caudal margin of same truncate, rounding laterad to the

has some resemblance to the species here described, but the features of the eyes, the presence of dark pronotal bars and the general curve of ovipositor (although this is exaggerated in the figure) convince us he had *capitatus* before him, his name accordingly falling in the synonymy under DeGeer's species. The color shade described and painted by Stoll is, also, very different from that found in the two individuals of *lanista*.

humeral sinus; lateral shoulders weakly indicated caudad, broadly rounded elsewhere; transverse sulcus placed slightly cephalad of the cephalic third: lateral lobes of the pronotum longer than deep; cephalic margin of the lobes straight oblique, ventro-cephalic angle rounded obtuse; ventral margin straight, weakly oblique, ventro-caudal angle broad obtuse; caudal margin with the ventral two-thirds oblique, moderately arcuate, sharply blending into the rounded obtuse-angulate, but distinct, humeral sinus. Tegmina slightly more than twice as long as the caudal femora, falling slightly short of the apex of the ovipositor, elongate lanceolate, the greatest width of the marginal and discoidal fields contained about seven times in the greatest length: costal margin straight, except for a short proximal and more gradual distal arcuation, sutural margin faintly sinuate, apex rather narrowly rounded. Wings reaching to the tegminal apices. Prosternum long bispinose: mesosternal lobes acute angulate: metasternal lobes rectangulate, none of the angles produced. Disto-dorsal abdominal segment divided mesad by an impressed fold (proximad) and a deep V-emargination (distad), the margin produced into spiniform lobes on each side of the median impression; supra-coxal emarginations very deep, arcuate: cerci tapering, acute, weakly arcuate: ovipositor moderately elongate, nearly a fourth longer than the caudal femora, straight except for a faint distal decurvature, faintly narrowed distad of the proximal third, this due to an offset of the cephalic margin, subequal in width thence, except that there is an almost impereeptible widening toward the distal fourth; apex moderately acute, ventral valve falling considerably short of the apex: subgenital plate with the distal margin V-emarginate mesad, this flanked by acute spiniform angles; lateral margins of the plate straight, converging distad to the processes margining the distal emargination. Cephalic and median femora relatively short, robust, the former slightly shorter than, and the latter subequal to, the length of the pronotal disk; cephalic femora with two teeth distad on the ventro-cephalic margin; median femora with the ventro-cephalic margin bearing three spines distad. All genicular lobes more or less distinctly spined except the cephalic lobe of the cephalic femora. Caudal femora slender, ventro-external margin with eight to nine spines, internal margin with seven to eight spines: caudal tibiae with the dorsal surface distinctly expanding distad.

The coloration has apparently altered somewhat in drying, but we are giving it as found. General color old gold, becoming dull wax yellow on the pronotum, primuline yellow on the pronotal disk. Head tinted with yellow citrine, with mouth-parts dull primuline yellow, a spot at each lateral base of the clypeus vandyke brown; eyes old gold, crossed by two lines of fuscous, which are connected caudad. Pronotum with a narrow cephalic marginal band and three broader caudal areas, one on the disk and one on each lateral lobe, of hellebore green. Tegmina with the anal and discoidal fields washed with saccardo's umber, the vicinity of the humeral trunk proximad yellow ocher, of the anal vein more russet; marginal field washed with veronese green, with a cloud of bice green, costal margin of this field veronese green to naples yellow. Cephalic tibiae with the usual black areas adjacent to the foramina distinct; median tibiae with a single median and paired lateral dots of fuscous. All spines

of the femora and of the dorsal margins of the caudal tibiae tipped with blackish fuscous, those of the ventral margins of the caudal tibiae paler fuscous tipped. Ovipositor largely mars brown, with a pale medio-longitudinal line, dorsal base pale.

*Measurements (in millimeters)*

| Porto Alegre, Brazil. | Length of body (exclusive of ovipositor) | Length of pronotum | Greatest (caudal) width of pronotal disk | Length of tegmen | Greatest width of tegmen (excluding anal field) | Length of caudal femur | Length of ovipositor |
|---|---|---|---|---|---|---|---|
| ♀ *type* | 42.5 | 10.5 | 6.7 | 55 | 8 | 26 | 29.5 |
| ♀ *paratype* | 41 | 10.5 | 6.9 | 53.5[22] | 7.3 | 26.5 | 37[22] |

A paratypic female bearing the same data as the type shows no important differences, except that the ovipositor is longer and more decidedly decurved in over half its length. The cephalic femora of the paratype have one or no spine, the median femora two or three, while the single caudal femur remaining has seven external and six internal spines. The coloration of the paratype is apparently altered, as it shows no greenish at all, and presumably the individual has been immersed in a liquid preservative at some time.

### AGROECIINAE

**Bertoniella agroecioides** Rehn

1911. *Bertoniella agroecioides* Rehn, Entom. News, xxii, p. 255, figs. 3 to 5. [Puerto Bertoni, Paraguay.]

Porto Majoli, State of Paraná. December, 1910. (Schrottky.) One female.

When compared with the allotypic female this specimen is seen to differ only in the faintly more elongate pronotum and the faintly shorter tegmina. These differences, however, are purely individual.

## GRYLLIDAE

### GRYLLINAE

**Nemobius hebardi** Rehn

1915. *Nemobius (Argizala) hebardi* Rehn, Proc. Acad. Nat. Sci. Phila., 1915, p. 290, figs. 4 and 5. [Buenos Aires (type) and Misiones, Argentina.]

São Paulo, State of São Paulo. January 29. One female.

This specimen has been compared with the type and paratypes of the species. It demonstrates the presence of a brachypterous condition in *hebardi*, as the tegmina cover but little more than

[22] Approximate as tips are damaged.

half of the abdomen and the wings are vestigial. This is the most northern known record for the species.

**Anurogryllus muticus** (DeGeer)

1773. *Gryllus muticus* DeGeer, Mém. Hist. Ins., iii, p. 520, pl. 43, fig. 2. [Surinam.]

Ypiranga, State of São Paulo. April 10 to November, 1910. (H. Lüderwaldt.) Ten females.

All of these individuals have caudate wings.

**Gryllus assimilis** (Fabricius)

1775. [*Acheta*] *assimilis* Fabricius, Syst. Entom., p. 280. [Jamaica.]

Salto Grande, State of São Paulo. February, 1911. (H. Lüderwaldt.) One female.

OECANTHINAE

**Ectecous hedyphonus** Saussure

1878. *E*[*ctecous*] *hedyphonus* Saussure, Mélang. Orthopt., ii, fasc. vi, p. 555. [Brazil.]

Santos, State of São Paulo. August, 1910. (H. Lüderwaldt.) Two males.

We have also seen a specimen from the collection of the Museum of Comparative Zoology, labelled "Mendez, Thayer Exp.," but we are unable to place the locality. When compared with a male of *cantans* Saussure, from "Southern British Guiana," in the collection of the Academy, the more evident features of difference appear to be the generally smaller size of *hedyphonus*, and the less strongly transverse speculum of the male tegmina of the sex; the transverse veins of the speculum in *hedyphonus* are more oblique and regularly spaced at their junction with the juxta-humeral portion of the specular margin, while in *cantans* they are more transverse, and at their junction with the same margin they are more bunched. The number of these veins varies from three to four, while the number of oblique veins in *hedyphonus* is seven to eight, and in our *cantans*, four to six.[23] Bruner[24] was correct in removing Giglio-Tos' *Ectecous borellii* from this genus. We have a paratypic pair (San Francisco, Bolivian Chaco), received from Borelli, and the species has no affinity with true *Ectecous*. It appears, instead, to belong in or

[23] We have used material of *cantans* from other localities, to be recorded later, in securing these counts.

[24] Ann. Carneg. Mus., x, p. 389, (1916).

very near to Saussure's *Prosthacusta*, which was based on *P. mexicana* Saussure (*Nemobius circumcinctus* Scudder). Until we are able to compare the two species we prefer to place *borellii* at least tentatively in *Prosthacusta*. Giglio-Tos' species is markedly different from the genotype, but in the important generic features it seems to fully agree. Bruner has referred *borellii* to Walker's *Luzara*, but we are not able to form any clear idea of this genus from Walker's description, while Kirby, from type examination, considers it a distinct genus related to *Paragryllus* and *Ectecous*, where *borellii* certainly does not go. We state this with the genotypes of both genera before us. Bruner's *Luzara boliviana* is extremely close to, if not identical with, *borellii*, a possibility he refers to in the original description.

**Endecous itatibensis** new species (Plate X, figs. 18, 19, 20, 21 and 22.)

This species is referred to *Endecous* with some doubt, as it has the dorsal surface of the caudal metatarsi biseriately serrulate, and the median tibiae have four distal spurs, instead of the former being uniseriately serrulate and the latter with three spines, which are supposed to be characters of *E. arachnopis*, the genotype. However, the agreement of most of the other characters is such that we do not feel warranted in generically separating this species without more knowledge of the genotype. From the description of *arachnopis* the present species differs in the much more elongate tegmina of the male, in the mediastine vein of the same having a number of rather weak branches, in the larger size and in the distal spine of the dorso-internal margin of the caudal tibiae being but slightly smaller than the others in the series, instead of very small.

From the species *E. lizeri*, which is being described elsewhere by us, the present species differs in its smaller size, more ample tegmina with more usual and regular venation, in the less projecting lateral lobes of the pronotum, in the less extensive subgenital plate of the male, and in the less attenuate and more expanded distal palpal joint. The female of *itatibensis* is not known.

*Type.*—♂; Itatiba, State of São Paulo, Brazil. April, 1910. (J. Lima.) [Acad. Nat. Sci. Phila., Type no. 5329.]

Size medium: form faintly compressed, abdomen cylindrical: surface in general smooth with a greater or lesser degree of adpressed pubescence, the dorsum of the pronotum, the occiput and the genae freer from this covering than the other portions of the body, the cephalic margin of the pronotal disk and the interantennal region with elongate bristle-like hairs. Head short, broad and relatively deep: occiput with its more elevated section short, thence cephalad the occiput is very declivent to the relatively narrow fastigium, which is low, narrow and bearing, on a level with the dorsal base of the antennae, the median ocellus: palpi elongate, very slender; third joint subequal in length to the fourth joint, the fifth joint faintly more than half again as long as the fourth joint, moderately arcuate, gently expanding in distal three-fifths, thence narrowing to the narrowly rounded apex: eyes ovoid in basal outline, their depth subequal to that of the infra-ocular portion of the genae, moderately prominent when seen from the dorsum: antennae elongate, about twice as long as the body, the proximal joint large, very strongly depressed. Pronotum, when seen from the dorsum, having its disk transverse subquadrate, slightly broader caudad than cephalad, the greatest length of the disk contained one and one-half times in the greatest width of the same; cephalic and caudal margins of disk subtruncate; median line with a sulcation which encloses an irregular carina, while caudad a transverse subelliptical area crosses the median line; lateral angles of the disk very broadly rounded: lateral lobes shallow, the greatest (cephalic) depth of the same contained about twice in the length of the lobes; ventro-cephalic angle broadly rounded, ventral margin ascending oblique-arcuate, ventro-caudal angle obsolete, the ventral margin regularly arcuate into the caudal margin of the disk; caudal half of the lateral lobes moderately impressed. Tegmina covering slightly more than the proximal half of the abdomen, dorsal field relatively broad, its greatest width contained about one and one-half times in the tegminal length: lateral field regularly narrowed distad; discoidal vein closely paralleling the humeral vein, bearing about nine poorly defined rami, which are elongate sigmoid proximad and angularly broken distad, a weakly indicated spurious vein connecting the veins at the point of fracture; humeral vein strong, gently arcuate except for a short distal section which is diverted toward the margin: discoidal vein distinct, gently arcuate in a reverse fashion from the humeral vein, the discoidal almost touching the humeral vein proximad; median vein weak; stridulating vein relatively weak, closely proximal in position on the tegmina, its transverse section gently arcuate; axillary veins two in number, converging toward the anal node; principal oblique vein straight oblique from the node to the periphery of the speculum, accessory oblique veins four in number; postaxillary veins two in number, longitudinal; diagonal vein short, sinuate, connecting the first postaxillary vein with the speculum: general form of the speculum circular-ovoid, the narrow portion directed proximad, the transverse veins two in number, regularly spaced, the proximal portion of the veins being sharply right-angled: distal margin of dorsal field in general form convex, but with three slight flattenings, one mesad and the others laterad. Wings aborted, not evident. Supra-anal plate moderately elongate, rounded trigonal, the lateral margins slightly constricted mesad and with the apex broadly rounded; surface of plate distinctly depressed

within its margins: cerci elongate, equal to the body in length, tapering: subgenital plate short, scoop-shaped, the distal margin narrowly V-emarginate, this giving the caudal aspect of the plate a reversed "hair-lipped" appearance. Cephalic and median femora subequal in length, each twice as long as the pronotal disk: cephalic tibiae with the cephalic face bearing a small elliptical tympanum, the caudal face imperforate. Caudal femora but faintly shorter than the body, robust, rather sharply tapering to the relatively small but abbreviate distal extremity: caudal tibiae very faintly longer than the femora, the dorsal margins with four pairs of articulate spines, which are not directly opposite one another in position, the external ones the longer and all faintly arcuate, dorsal margins distinctly spinoso-serrate between the articulate spines, the external margin formula reading distad (from area bearing large spines only) IiiiiiIiiiiiIiiI, the external margin formula reading IiiiIiiiIiiI; distal internal spurs with the dorsal one very long and acuminate, reaching slightly distad of the middle of the metatarsus, the median one slightly shorter than the dorsal one, the ventral one quite short, distinctly less than one-half as long as the median one; distal external spurs with size gradation as in the internal series, but the length of all distinctly less than in the other series: caudal metatarsi biseriate serrulate dorsad, the external and internal margins each with seven spinulations, the disto-internal spur about one-half again as long as the external one.

General color kaiser brown to ochraceous-tawny (on lower head, mouthparts, palpi and coxae), the abdomen mummy brown, the tegmina pale chestnut-brown; cerci passing from mummy brown (proximad) to ochraceous-tawny; antennae (exclusive of proximal joint) chestnut-brown proximad, narrowly buffy annulate, to ochraceous-tawny distad; eyes pale olive brown.

Length of body, 19 mm.; length of pronotum, 3.5; greatest (caudal) width of pronotum, 4.1; length of tegmen, 8.2; greatest width of dorsal field of tegmen, 5.7; length of caudal femur, 12.5; length of caudal tibia, 13.3.

The type of this most interesting species is unique.

### ENEOPTERINAE

**Tafalisca paulista** new species (Plate X, figs. 23, 24 and 25.)

Apparently related to *T. brasiliana*, from "Brazil," and *bahiensis*, from northeastern Brazil, differing from *brasiliana* in the much more elongate, more slender caudal tibiae, in the spining of the caudal metatarsi, in the acute apex of the ovipositor, in the largely infuscate pronotum, in the pencilling of the tegminal venation and the coloration of the limbs; from *bahiensis* the new species differs in the more elongate limbs, particularly the caudal pair, the smaller apex of the caudal femora, the much more elongate caudal tibiae, the more compressed head and pronotum, the latter in consequence more longitudinal, the relatively broader

eyes, the infuscate pronotum and longitudinal fuscous lining of the caudal femora.

*Type.*— ♀ ; França, State of São Paulo, Brazil. January, 1911. (E. Garbe.) [Acad. Nat. Sci. Phila., Type no. 5337.]

Size rather large: form slender (for the genus), subcompressed: surface covered with adpressed golden pile. Head with its caudal width subequal to the cephalic width of the pronotum, greatest depth of the head nearly one and one-half times the greatest width of the head across eyes: occiput rather strongly inflated and rounded, strongly arcuate declivent to the interocular region, which is hardly produced or angulate when seen from the side, in width slightly less than that of the proximal antennal joint; median ocellus poorly indicated; facial section of the rostrum weakly compressed: eyes but little prominent, rather small, broad ovoid in basal outline, their depth but slightly greater than that of the infra-ocular portion of the genae: palpi elongate, slender, the third and fourth joints subequal in length, the fourth more slender, particularly proximad, than the third joint; fifth joint subequal in length to the fourth joint, infundibuliform, very broadly arcuate, the distal margin strongly oblique, arcuate, the immediate apex blunted: antennae nearly three times as long as the body; proximal segment inflated on the ventral surface. Pronotum strongly arcuate dorsad in transverse section, broadly rounding into the lateral lobes, greatest median length of the pronotum subequal to the greatest caudal width: cephalic margin of disk strongly and regularly arcuato-emarginate; caudal margin rather strongly arcuate; lateral borders of disk faintly converging cephalad: lateral lobes of pronotum longitudinal, the greatest depth caudad and this contained twice in the length of the lobes; ventro-cephalic angle rather broadly rounded; ventral margin straight, slightly declivent; ventro-caudal angle broadly rounded rectangulate, the lobes moderately impressed ventro-caudad: all margins of the pronotum cingulate, the ventro-caudal section of the lobes broadly so. Tegmina reaching to the apex of the abdomen: lateral field broad, its greatest width contained not quite four times in the tegminal length, full, the costal margin arcuate; mediastine vein with four rami, the field with three proximal free veins; humeral vein simple, following the curve of the mediastine vein: dorsal field subequal in width to the lateral field; median vein with three sublongitudinal rami distad, the median origin of which is not sharply indicated; ulnar vein biramose; anal vein simple; axillary veins four in number, all the veins and rami of the dorsal field parallel, but weakly oblique, cross-veins indicated, and then but weakly, distad and mesad. Wings surpassing the closed tegmina by nearly three-fifths the pronotal length. Ovipositor three-fourths the length of the caudal femora, gently arcuate in lateral outline, depressed; distal valves faintly wider than the main shaft of the ovipositor, the base of the dorsal valves indicated by a very weak, transverse carina, the external margin being weakly toothed at the marginal end of the carina, external margins of the dorsal valves regularly arcuate-convergent from the middle to the acute apices of the valves, the distal third of the surface of the valves transversely scored, this area obliquely delimited mesad and causing the external margin to be finely crenulate: ventral valves of approximately the same length and shape as the dorsal

valves, with the external margins more decidedly crenulate mesad and the ventral surface smooth: cerci two-thirds as long as the caudal femora, tapering, clothed with a thick coat of short, adpressed hairs and numerous erect, much longer hairs. Cephalic and median limbs robust, moderately compressed: cephalic femora but slightly longer than the dorsal length of the pronotum, median femora subequal in length to the cephalic femora: cephalic tibiae about a fourth longer than the femora, imperforate. Caudal limbs rather slender (for the genus): caudal femora nearly as long as the tegmina, surpassing the apex of the abdomen by about half the median length of the pronotum, the greatest depth of the femora contained three and one-half times in the greatest length of the same; the femoral form rather regularly tapering from the proximal third to the apex: caudal tibiae very faintly longer than the caudal femora, rather heavy: dorsal margins armed with five major spines, those of the internal margin much longer than the external spines; intercalated spinulations of external margin—3–2–2 (or 1)–1, of internal margin—3 (or 2)–3 (or 2)–3 (or 2)–2; dorsal disto-internal spur slightly over twice the length of the ventral one: caudal metatarsi rather short, armed on each dorsal margin with two spinulations; metatarsal spur elongate, reaching nearly to the middle of the third tarsal joint.

General color dull ochraceous-buff, marked with fuscous as follows: paired, weakly colored and poorly defined areas dorso-caudad of the eyes; the whole of the pronotal surface excepting the narrow ventral section of the lateral lobes and a faint tawny lining along the medio-longitudinal line; a weak infuscation proximad on the humeral trunk; a genicular darkening on the cephalic femora and median femora and tibiae; a narrow medio-longitudinal line on the external face of the caudal femora, a proximal, a more distinct median cloud on the dorsal surface of the same and a decided distal infuscation; caudal tibiae and two proximal tarsal joints fuscous, except for a pale area proximo-dorsad on the tibiae. Eyes mars brown; antennae pale sanford's brown. Venation of the tegmina pencilled with ferruginous to bay. Ovipositor chestnut, lined on external face with black, these covering the greater portion of the valves. Caudal tibiae with the spines dull burnt sienna, at the bases and the tips washed with blackish-fuscous. Abdomen with the dorsal surface blackish fuscous.

Length of body, 23 mm.; length of pronotum, 4.7; greatest (caudal) width of pronotum, 4.3; length of tegmen, 16.2; length of caudal femur, 19.6; length of ovipositor, 10.2.

The type of this most interesting and strongly characterized species is unique.

## Explanation of Plate X

Fig. 1.—*Strongylopsalis iheringi* new species. Dorsal outline of disto-dorsal abdominal segment, pygidium and forceps of male (*type*). (× 5½)

Fig. 2.—*Musoniella ipiranga* new species. Pronotum of male (*type*). Dorsal outline. (× 4)

Fig. 3.—*Musoniella ipiranga* new species. Tegmen of male (*type*). (× 1½)

Fig. 4.—*Paraphasma paulense* new species. Head, pronotum, mesonotum and tegmina of male (*type*). Dorsal view. (× 2)

Fig. 5.—*Paraphasma paulense* new species. Subgenital plate of male (*type*). (Greatly enlarged.)

Fig. 6.—*Spathalium helios* new species. Dorsal view of pronotum of female (*type*). (× 2)

Fig. 7.—*Spathalium helios* new species. Lateral view of pronotum of female (*type*). (× 2)

Fig. 8.—*Parossa ampla* new species. Pronotum of female (*type*). Dorsal view. (× 3)

Fig. 9.—*Parossa ampla* new species. Tegmen of female (*type*). (× 2)

Fig. 10.—*Parossa bimaculata* (Giglio-Tos). Tegmen of female. Sapucay, Paraguay. [A. N. S. P.] (× 2)

Fig. 11.—*Cornops ignotum* new species. Lateral view of fastigium of male (*type*). (Greatly enlarged.)

Fig. 12.—*Cornops ignotum* new species. Dorsal view of fastigium of male (*type*). (Greatly enlarged.)

Fig. 13.—*Cornops ignotum* new species. Lateral view of apex of abdomen of male (*type*). (Greatly enlarged.)

Fig. 14.—*Bucrates lanista* new species. Head and pronotum of female (*type*). Dorsal view. (× 1½)

Fig. 15.—*Bucrates lanista* new species. Pronotum of female (*type*). Lateral view. (× 1½)

Fig. 16.—*Bucrates lanista* new species. Subgenital plate of female (*type*). (Greatly enlarged.)

Fig. 17.—*Bucrates lanista* new species. Lateral view of apex of abdomen of female (*type*). (Natural size.)

Fig. 18.—*Endecous itatibensis* new species. Subgenital plate of male (*type*). (Greatly enlarged.)

Fig. 19.—*Endecous itatibensis* new species. Dorsal field of tegmen of male (*type*). (× 4)

Fig. 20.—*Endecous itatibensis* new species. Palpus of male (*type*). (Greatly enlarged.)

Fig. 21.—*Endecous itatibensis* new species. Caudal tarsus and apex of tibia of male (*type*). Internal face. (Greatly enlarged.)

Fig. 22.—*Endecous itatibensis* new species. Caudal tarsus and apex of tibia of male (*type*). Dorsal face. (Greatly enlarged.)

Fig. 23.—*Tafalisca paulista* new species. Head and pronotum of female (*type*). Dorsal view. (× 3)

Fig. 24.—*Tafalisca paulista* new species. Apex of ovipositor from dorsum. *Type*. (Greatly enlarged.)

Fig. 25.—*Tafalisca paulista* new species. Caudal limb of female (*type*). (× 3)

# CONTENTS

A Revision of the North American Species of the Tipulid Genus Pachyrhina Macquart, with Descriptions of New Species (Diptera). By William G. Dietz . . . 105
(Issued June 10, 1918.)

New Genera and Species of Melanopli found within the United States (Orthoptera; Acrididae). By Morgan Hebard . . . . . 141
(Issued June 17, 1918.)

The Evolution of the Abdominal Pattern in Tabanidae (Diptera). By Werner Marchand . . . . 171
(Issued June 17, 1918.)

On Dermaptera and Orthoptera from Southeastern Brazil. By James A. G. Rehn . . . . . 181
(Issued June 17, 1918.)

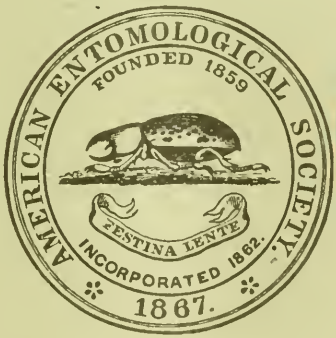
VOLUME XLIV NUMBER 3

SEPTEMBER 1918

# TRANSACTIONS

OF THE

# AMERICAN ENTOMOLOGICAL SOCIETY




PUBLISHED BY THE AMERICAN ENTOMOLOGICAL SOCIETY AT THE ACADEMY OF NATURAL SCIENCES

PHILADELPHIA

SUBSCRIPTION PRICE FOUR DOLLARS PER VOLUME

# THE AMERICAN ENTOMOLOGICAL SOCIETY

PHILADELPHIA

Founded 1859 Incorporated 1862

Organized as "The Entomological Society of Philadelphia," the present title was adopted February 11, 1867.


PRESIDENT
Henry Skinner

VICE-PRESIDENT
James A. G. Rehn

CORRESPONDING SECRETARY
Morgan Hebard

RECORDING SECRETARY
R. C. Williams, Jr.

TREASURER
Ezra T. Cresson

| PUBLICATION COMMITTEE | FINANCE COMMITTEE | PROPERTY COMMITTEE |
|---|---|---|
| James A. G. Rehn<br>*Editor* | James A. G. Rehn<br>*Chairman* | Ezra T. Cresson, Jr.<br>*Librarian* and *Custodian* |
| Ezra T. Cresson | D. M. Castle | Morgan Hebard |
| Philip P. Calvert | Morgan Hebard | Philip Laurent |


Meetings held (alternately with those of the Entomological Section of the Academy of Natural Sciences of Philadelphia) on the fourth Thursday of September, October, November, January, February, March, April and May, and on the second Monday of June and December (annual meeting). The offices, meeting room, library and collections of the Society are in the Entomological Department of the Academy of Natural Sciences of Philadelphia, Logan Square.

## SERIAL PUBLICATIONS OF THE SOCIETY

Proceedings of the Entomological Society of Philadelphia, volumes I–VI, 1861–1867. Out of print and cannot be supplied.

Transactions of the American Entomological Society, volumes I–IV, out of print and cannot be supplied; V–X, $5.00 per volume; XI–XLIII, $4.00 per volume. Published in annual volumes of quarterly parts.

The Practical Entomologist, volumes I–II, 1865–1867. Price, $1.00 for the two volumes.

Memoirs of the American Entomological Society, number 1, 1916, price $2.00; number 2, 1917, price $4.50. Published irregularly.

Entomological News, volumes I–XXVIII. Price $2.00 per volume. Published in conjunction with the Entomological Section of the Academy of Natural Sciences of Philadelphia.

Various irregular, non-serial publications have been issued, which may be found in our price lists under their respective authors.

To establish the date of issue, each paper, as soon as completed, is placed on sale and a copy of it is mailed to each of the following institutions, with a request that it be placed in their library for reference.

Boston Society of Natural History
American Museum of Natural History
Smithsonian Institution
Field Museum of Natural History
California Academy of Sciences
Entomological Society of Ontario

Separates of papers published in the Proceedings and Transactions, if not out of print, can be supplied at prices given in our price lists, which are sent upon application, stating order or orders desired. The Society has also inaugurated a system of subscription to papers published by it on individual orders, which arrangement is of material benefit to the student who desires promptly the literature on any special group, but who does not desire to subscribe to entire volumes of the Transactions. A method of notification of the appearance in its publications of papers relating to individual orders or subjects has been developed by the Society. Information concerning these arrangements supplied upon application.

In sending subscriptions or in making inquiries relative to publications, address:

THE AMERICAN ENTOMOLOGICAL SOCIETY,
PUBLICATION DEPARTMENT,
The Academy of Natural Sciences of Philadelphia,
Logan Square.

OCT 31 1918
National Museum

# A STUDY OF THE NORTH AMERICAN EUMASTACINAE (ORTHOPTERA; ACRIDIDAE)

BY JAMES A. G. REHN AND MORGAN HEBARD

The subfamily Eumastacinae is an assemblage of grasshoppers which to-day comprises about forty-five genera and approximately one hundred and fifty species. The group is clearly of tropical origin, and is represented by a far greater number of forms in both the Oriental and African regions than in the American tropics. In the Old World representatives are found as far north as Turkestan, Kashmir, Bhotan, Yunnan, China and Japan, while in Africa no species have been reported from north of the tropical area. In North America, north of Mexico, a single genus and species has been known from California for some years, but since its description in 1898 little additional information has been published regarding it.

In the field studies made within the United States by the present authors, we have always paid particular attention to eumastacids when we found them present at a locality. In consequence we have before us a very considerable series of the subfamily from the United States, largely of our own collecting and all contained in the Philadelphia collections. Careful study shows that two genera are present, *Morsea*, which was previously known, and a new one related to it, while the single species of *Morsea* is found divisible into three geographic races, one of which is found considerably to the eastward of the previously known range of the genus.

The features of the subfamily have been discussed by Burr in his last summary of the group.[1] At this writing, without a broader personal knowledge of the exotic genera, it seems undesirable to re-diagnose the subfamily, the recognition of which will not cause difficulty on account of the distinctive and in fact often remarkable form of the species.

In the United States the subfamily occurs only in the southwestern states, north as far as the vicinity of San Francisco (Mt. Tamalpais), California, southeastern Nevada (Crestline and Caliente) and from the Pacific Coast area east to central Arizona

[1] Genera Insect., Orth., Eumastac., pp. 1 to 2, (1903).

(vicinity of Prescott). In much of this area it is not present, requiring favorable zonal conditions for its occurrence. Both of our genera are almost entirely limited to the Upper Sonoran Life Zone in their distribution. Nothing whatever is known of the distribution of the two North American genera south of the Mexican line.

Both of the genera found in the United States belong to the section Eumastaces, or restricted subfamily Eumastacinae if the group is called a family (Eumastacidae), as done by Burr. Their relationship is clearly with *Masyntes* Karsch, as indicated by Scudder and Burr in the case of *Morsea,* no close affinity existing with *Eumastax, Paramastax* and *Scirtomastax,* the other genera of the section. Our two genera are, however, much more nearly related to one another than either one is to the West Indian and South American *Masyntes.* Both genera are completely apterous, without continuous or definite lateral carinae on the pronotum, the caudal margin of the disk of which is appreciably emarginate mesad, the fastigium is produced and entire, with the dorsal section of the frontal costa broadened. From *Masyntes, Morsea* and the new *Psychomastax* can be readily differentiated by having the spines of the internal margin of the caudal tibiae uniform in length, by their apterous condition and entire and produced fastigium.[2]

In habits all the forms found within the territory considered are thamnophilous, being particularly fond of perching on the tops of various species of bushes, spiny or otherwise, which make up the chaparral of the western or coastal slopes of the southern Californian and Coast Range Mountains. In such situations you will, by careful scrutiny, find them with short antennae erect and parallel, caudal limbs akimbo, the whole insect picturing alertness and vigor. Their ability to jump is developed in full proportion

[2] A feature of interest in both of the genera here studied is the presence on the ventral surface of the ninth to tenth antennal joint of a distinct, though minute, spiniform tooth, in both sexes. In examining representatives of seven other genera of Eumastacinae we find a similar development indicated as follows:

Present on the eleventh segment in *Erianthus malcolmi,* ♂; *Erucius vitreus,* ♂ and ♀; *Erucius dimidiatipes,* ♂; *Masyntes gundlachi,* ♀.

Present on the twelfth segment in *Erucius magnificus,* ♂.

Present on the ninth segment in *Thericles gnu* and *quagga,* ♀.

Not indicated in *Brachytypus burri, Episactus brunneri* and *Masyntes tigris.*

to their very long and lever-like caudal limbs, as a single bound will often place them in a place of safety on a chamisal bush well out of reach, except by a new and cautious advance through the heavy brush, often with similar disappointing results. Steady and persistent beating, while by no means easy on account of the character of the cover, is probably the best method of securing series of these interesting little grasshoppers.

The two genera found in our territory may be distinguished by the following features:

A. Form slender. Head narrow in proportion to depth. Fastigium, in both sexes, projecting a distance at least one-third of width of same, when seen from dorsum, narrower; in profile fastigial angle is acute. Frontal costa very narrow and subequal mesad and ventrad, widened briefly dorsad. Antennae with tooth on ventral surface of tenth segment.[3] Lateral lobes of pronotum with ventro-caudal angle rounded rectangulate. Cerci of ♂ compressed and falcate ventrad in distal section. Subgenital plate of ♂ with a median linguiform process directed dorso-cephalad from disto-dorsal margin, which is entire. Limbs more elongate and slender. **Morsea** Scudder

AA. Form relatively robust. Head broader than in alternative. Fastigium, in both sexes, projecting less than one-third of the width of the same, when seen from the dorsum, broader; in profile fastigial angle is right-angled. Frontal costa of average width, widening dorsad. Antennae with tooth on ventral surface of ninth segment. Lateral lobes of pronotum with ventro-caudal angle not rounded, rectangulate. Cerci of ♂ simple, styliform. Subgenital plate of ♂ without a median linguiform process, disto-dorsal portion of plate made up of two lateral, mesad attingent sections.

**Psychomastax** new genus

In the series before us are present three hundred and eight specimens of the subfamily from the area under discussion, by far the greater portion belonging to the genus *Morsea*. As individuals of this group are very active and elusive, the series represents a far greater amount of persistent work than the number alone would suggest to those unacquainted with these active bush-loving insects.

[3] In *Morsea* this tooth occasionally appears to be on the eleventh segment, but this will be found to be due to an adventitious and incomplete division of the third segment.

**MORSEA** Scudder

1898. *Morsea* Scudder, Psyche, viii, p. 179.
1899. *Morsea* Burr, Anal. Soc. Españ. Hist. Nat., xxviii, pp. 95, 277.
1899. *Morsea* Scudder, Proc. Davenp. Acad. Nat. Sci., viii, p. 18.
1901. *Morsea* Bruner, Biol. Cent.-Amer., Orth., ii, pp. 22, 24.
1903. *Morsea* Burr, Gen. Insect., Orth., Eumastac., pp. 15, 17.
1909. *Morsea* Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1909, p. 420.
1910. *Morsea* Kirby, Syn. Catal. Orth., iii, p. 79.

Genotype: *Morsea californica* Scudder.

*Description of Genus.*—Form elongate, slender, apterous. Head deep, narrow; face declivent; fastigium in profile acute-angulate, from dorsum projecting cephalad of eyes a distance not more than one-half of its width, margin of apex of fastigium entire, not divided, subtruncate; occiput and fastigium with a distinct but low medio-longitudinal carinula: frontal costa very narrow, subequal in width mesad and ventrad, widening regularly from the paired ocelli to fastigium: eyes large, very prominent in male: antennae thirteen-jointed, slender immediately distad of first and second joints, thence depressed and spatulate or subspatulate, apex briefly acute, ventral tooth on tenth segment. Pronotum distinctly (♂) or weakly (♀) longitudinal, dorsum tectate in female, more arcuate transverse in male; distinct median carina indicated, no true lateral carinae present, discontinuous and faint ridges giving a semblance of lateral carinae; caudal margin of pronotal disk with median V-emargination of variable distinctness. Apex of male abdomen recurved: supra-anal plate deflexed, elongate trigonal; cerci compressed, with falcate distal sections; subgenital plate short, forming a chitinous arch bearing a median linguiform process, this abruptly directed cephalad along the body axis and between the cerci. Interspace between the mesosternal lobes strongly transverse, narrowing cephalad; mesosternal lobes contiguous. Limbs slender: caudal femora with apices of genicular arches and dorsal carinula spiniferous, genicular lobes very minutely spinulose: caudal tibiae with spines of each series uniform in length, those of internal series shorter than external, internal distal spurs distinctly longer than external: caudal tarsi elongate, proximal joint but faintly shorter than second and third joints united; large arolia present.

*History.*—The genus was founded in 1898 on *Morsea californica*, being very briefly described from two specimens which were considered "possibly immature." In the light of our present knowledge this appears very certain. The references between the date of the original description and 1909 contain no additional information. In the latter year Rehn and Hebard reported the capture of additional material of the genus and published the first figures of the same. These authors recognized a geographic race *Morsea californica tamalpaisensis* occurring on Mount Tamalpais, north-central California.

*Distribution.*—From north-central California (Mount Tamalpais), south in the chaparral belt of the Coast Range and adjacent lowlands to the mountains of southern California and portions of the lowlands at their bases (south to Nellie, San Diego County), not occurring as far as known on the eastern or desert slope; from south-eastern Nevada (Crestline and Caliente) southeast to central Arizona (vicinity of Prescott). No material has been taken in the desert areas between the two regions known to be inhabited by the genus.

*Remarks.*—The relatively extensive series before us is not as rich proportionately in adult material as we might care to have it. Also, on account of the fragility of the insects, perfect specimens are not the rule. However, the material clearly demonstrates that while a single species alone is present, it is divisible into three well-marked geographic races or subspecies. These are typical *Morsea californica* of the mountains of southern California, *M. c. tamalpaisensis* of the Mount Tamalpais region in the Coast Range north of San Francisco Bay and *M. c. dumicola* of the central Arizonan and higher southern Nevadan regions. The first two are known to intergrade in material from Del Monte, California, but no material from localities between the ranges of typical *californica* and *c. dumicola* is known, and the two forms are considered subspecies solely on the degree of difference.

In California the genus is a member of the presumably ancient chaparral fauna, while in Arizona and in Nevada it is present in what might be considered an equivalent of the same, although little definite or comparable information is available regarding

the relative antiquity of the faunas of the areas inhabited. It seems probable to us that the present distribution of the genus is due to two parallel lines of dispersal extending north from an original center in Mexico, where possibly the two forms, or others very closely related, will be found to intergrade. The absolute lack of Mexican information makes any further theorizing along these lines unwarranted at this time. Another possibility is that *Morsea* originally occurred in what is now the hot, arid Lower Sonoran Zone, and possibly in the mountains as well, that increasing aridity and temperature, with the competition of a new fauna and the elimination or great restriction of its preferred habitat, forced it into its present zonal position. Some slight evidence in support of this hypothesis might be found in the occurrence of the genus in "islands" within Lower Sonoran conditions, as at Roscoe, California, but this might be explained equally well as a downward extension from the adjacent San Gabriel Mountains, where the genus is widely distributed, along the course of the broad Tujunga Wash.

Considerable difficulty is experienced in determining accurately whether material of this genus is adult. Having no criterion of wing development we are largely forced to use the abdominal appendages as evidence. In the male sex this method is satisfactory, but in the female sex there is difficulty, as the ovipositor jaws and surrounding plates show little difference in the adult and in the instar preceding maturity. In this sex the general firmer texture of the chitin and absence of shrivelling will usually indicate the adult, but occasional specimens are not easily placed.

### *Key to Subspecies*

A. Fastigium of ♂, when seen from dorsum, projecting cephalad of cephalic margin of eyes less than one-half of width of fastigium (pl. XII, figs. 12 and 13); fastigio-facial angle, seen in profile, acute but not in the least concave ventrad.[4] Antennae moderately expanded and subspatulate distad. Infraocular portion of genae in ♂ no deeper than one-half depth of eye, in ♀ equal to two-thirds of depth of eye. Lateral lobes of pronotum proportionately longer and more shallow. Cerci of ♂ proportionately more slender, moderately falcate distad.

[4] Occasional females of *M. c. californica* show a tendency of this sort, but this is apparently merely an individual fluctuation, as they are otherwise quite typical.

B. Facial line, when seen from side, more sharply inflated between antennae. Fastigio-facial angle less strongly acute (pl. XII, figs. 2 and 6), when seen from side. Eyes in latter view proportionately smaller and more angulate dorsad and ventrad. Limbs appreciably longer and more slender. Caudal tarsi proportionately longer.

**Morsea californica californica** Scudder

BB. Facial line, when seen from side, more regularly arcuate in its entirety. Fastigio-facial angle more strongly acute (pl. XII, figs. 3 and 7), when seen from side. Eyes in lateral view proportionately longer and more rounded dorsad and ventrad. Limbs appreciably shorter and more robust. Caudal tarsi proportionately shorter.

**Morsea californica dumicola** new subspecies

AA. Fastigium of ♂, when seen from dorsum, projecting cephalad of cephalic margin of eyes one-half of width of fastigium (pl. XII, fig. 14); fastigio-facial angle, when seen in profile, very acute, generally slightly concave ventrad (pl. XII, figs. 4 and 8). Antennae markedly spatulate distad. Infraocular portion of genae in ♂ approximately equal to two-thirds of depth of eye, in ♀ subequal to depth of eye. Lateral lobes of pronotum proportionately shorter and deeper. Cerci of ♂ proportionately more robust, sharply and strongly falcate distad.

**Morsea californica tamalpaisensis** Rehn and Hebard

**Morsea californica californica** Scudder (Plate XI, fig. 2; XII, figs. 2, 6, 10, 12, 16, 18 and 20; XIII, figs. 2, 6, 8 and 10).

1898. [*Morsea*] *californica* Scudder, Psyche, viii, p. 179. [Cahon Pass, southern California; Mount Wilson, near Los Angeles, California.]

1899. *Morsea californica* Burr, Anal. Soc. Españ. Hist. Nat., xxviii, p. 278. [Same localities.]

1901. *Morsea californica* Bruner, Biol. Cent.-Amer., Orth., ii, p. 25. [Same localities.]

1903. *M*[*orsea*] *californica* Burr, Genera Insect., Eumastacidae, p. 17. [California.]

1909. *Morsea californica* Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1909, p. 420, figs. 6 and 7. [Mount Lowe, Echo Mountain and Mount Wilson, southern California.]

The typical form of *Morsea californica* differs from the subspecies *dumicola* and *tamalpaisensis* in the features indicated under the latter forms.

*Types.*—"Two specimens . . . possibly immature," from Cahon Pass, between the San Gabriel and San Bernardino Mountains, southern California, July 19, and Mount Wilson, San Gabriel Range, southern California, July 27. These specimens are presumably males from the size indicated. The Mount Wilson specimen is here indicated as the single type.

The present location of these specimens is in the Scudder Collection at the Museum of Comparative Zoölogy, Cambridge, Massachusetts.

*Description of Male.*—(Mount Wilson, San Gabriel Mountains, Los Angeles County, California. Elevation, 5000 feet. September 15, 1908. Collected by Fordyce Grinnell Jr. [Acad. Nat. Sci. Phila.]) Size medium. Head with profile of occiput arcuate, elevated appreciably dorsad of the pronotum; fastigium with angle in profile slightly more acute than a right angle, when seen from the dorsum moderately projecting, subtruncate with the lateral angles well rounded: facial line arcuate in profile, the regular curve not broken by a projection to the fastigio-facial angle; frontal costa very strongly indicated, margins markedly carinate, very narrow ventrad of the insertion of the antennae, the marginal carinae subattingent between the antennal bases, sinuate divergent dorsad of the antennae to the fastigium, the floor of the costa in this section plane and with a faint median carinula dorsad; supplementary facial carinae decided, subparallel, continued around ventro-cephalic border of the eyes to the antennal bases: eyes prominent, moderately inflated, ovate in basal outline, the greatest depth of eye slightly more than twice that of the infra-ocular portion of the genae: antennae appreciably longer than the dorsal length of the pronotum, composed of thirteen to fourteen joints, slender, subcylindrical proximad, slightly depressed and subspatulate distad, apex very acute.

Pronotum simple, sellate, with dorsal line practically straight in profile: cephalic margin of disk truncate, caudal margin of disk with a shallow, broad emargination; dorsal carina distinct but low, subobsolete cephalad; cephalad are present faint indications of diverging lateral carinae: lateral lobes distinctly longer than deep, the depth contained nearly twice in the length of the same; cephalic margin and the ventro-cephalic angle broadly arcuate, ventral margin sinuato-truncate, ventro-caudal angle rounded rectangulate, caudal margin truncate; a distinct median subvertical section of a transverse sulcus indicated on the lateral lobes.

Cerci moderately compressed, in section excavate on the internal face, with a convexity on the external face and slightly flattened proximo-dorsad; in form moderately longitudinal, the proximal half subequal in depth and straight, the distal section decurved attenuate to the distinctly aciculate apex, which is not recurved.

Limbs slender. Cephalic femora slightly shorter than the combined length of the head and pronotum, cephalic tibiae subequal to the femora in length. Median femora slightly shorter than the cephalic femora. Caudal femora three-fourths as long as the body, caudal tibiae subequal in length. Caudal tarsi equal to two-fifths of the length of the caudal tibiae, the proximal joint but faintly shorter than the second and third combined, the second about two-thirds the length of the third.

*Description of Female.*—(Mount Lowe, San Gabriel Mountains, Los Angeles County, California. Elevation, 5200 to 5600 feet. August 8, 1907. Collected by M. Hebard. [Hebard Collection.]) The characters here given are those of difference from the male sex.

Size larger. Head with the occiput elevated but little dorsad of the pronotal disk; fastigium with angle in profile slightly more acute than in male, faintly more projecting cephalad, when seen from the dorsum of similar form, but distinctly broader; frontal costa not specially narrowed between the antennal bases, but faintly compressed ventrad of the median ocellus, with very faintest indication of a median carinula dorsad;[5] eyes much less prominent, very sharp ovate in basal outline, the apex dorsad, the cephalic margin flattened arcuate, the caudal margin strongly arcuate, the ventral margin subangulate, greatest depth of eye one and one-third times that of the infra-ocular portion of the genae: antennae approximately subequal to the dorsal length of the pronotum, distinctly shorter than in the male, distal section rather more broadly spatulate than in the male when compared with the slender proximal portion.

Pronotum as a whole proportionately deeper than in the male, the dorsum more tectate in transverse section: cephalic margin of disk arcuato-truncate, caudal margin of disk subtruncate with a shallow, broad, median emargination; dorsal carina moderately elevated, much more distinct than in the male; in the region of the lateral carinae are present low, short, disconnected carinulae, which in general are slightly divergent caudad: lateral lobes with cephalic margin distinctly oblique truncate to the ventro-cephalic angle.

Cephalic femora about one and one-third times as long as the disk of the pronotum. Median femora subequal in length to the median femora. Caudal tibiae faintly longer than the femora.

*Measurements (in millimeters).*—These figures are of maximum and minimum specimens and of others noteworthy for special features.

| ♂ | Length of body | Length of antenna | Length of pronotum | Length of cephalic femur | Length of median femur | Length of caudal femur |
|---|---|---|---|---|---|---|
| Del Monte, California | 8.2 | — | 1.4 | 2.7 | 2.3 | 7.6 |
| Del Monte, California | 8.7 | 2.3 | 1.3 | 2.3 | — | 7 |
| Del Monte, California | 9.7 | 2.7 | 1.5 | 2.6 | 2.4 | 7.9 |
| Del Monte, California | 10.5 | 2.7 | 1.5 | 2.8 | 2.4 | 8.5 |
| Roscoe, California | 11.2 | 2 | 1.7 | 2.4 | 2.3 | 8.4 |
| Roscoe, California | 11 | 2.3 | 1.7 | 2.8 | 2.5 | 9 |
| Echo Mountain, California | 9.6 | 2.3 | 1.5 | 2.4 | 2.2 | 7.4 |
| Echo Mountain, California | 10.4 | 2.3 | 1.6 | 2.7 | 2.3 | 8.4 |
| Mount Lowe, California | 11.4 | 2.4 | 1.7 | 2.9 | 2.6 | 9 |
| Mount Lowe, California | 12.2 | — | 2.2 | 3.7 | 3.3 | 10.4 |
| Mount Wilson, California | 11 | 2.8 | 1.9 | 3.2 | 2.9 | 9 |
| Coahuila, California | 10.9 | 2 | 1.5 | 2.4 | 2.3 | 8.4 |

[5] The margins of the costa may be faintly compressed or completely subparallel in the female sex, the indication of a median dorsal carinula apparent or completely absent.

| ♀ | Length of body | Length of antenna | Length of pronotum | Length of cephalic femur | Length of median femur | Length of caudal femur |
|---|---|---|---|---|---|---|
| Del Monte, California | 15.5 | 1.9 | 1.8 | 2.6 | 2.4 | 8.6 |
| Del Monte, California | 16.8 | 2.2 | 2 | 2.7 | 2.6 | 9.2 |
| Roscoe, California | 15.2 | 1.7 | 1.9 | 2.1 | 2.2 | 9.3 |
| Roscoe, California | 16.9 | 1.7 | 2.1 | 2.3 | 2.6 | 9.8 |
| Echo Mountain, California | 12.5 | — | 1.6 | 2.1 | 2 | 8.6 |
| Echo Mountain, California | 15.4 | 2 | 2.1 | 2.7 | 2.7 | 10.2 |
| Mount Lowe, California | 16.5 | 2.6 | 2.6 | 3.4 | 3.5 | 12.2 |
| Mount Lowe, California | 19 | 2.2 | 2.5 | 2.9 | 3.1 | 12 |
| Nellie, California | 18 | 2.1 | 2.3 | 2.8 | 3.1 | 11 |

*Color Notes.*—This form shows several leading types of basic coloration, each combined, in greater or lesser degree of intensification, with paired dark lateral bars, these latter varying in shade from dark olive-gray to fuscous-black. The base color appears to be entirely independent of the barring and probably is less genetic than the pattern. In its extreme condition the barring consists of broad postocular bars involving almost all of the genae, the lateral lobes of the pronotum, the pleura and sharply defined broad areas on the sides of the abdomen, extending to the apex of the latter. With this is rarely associated a narrow medio-longitudinal bar on the head or pronotal disk. The lateral bars reduce down to faint indications limited to the postocular region, the dorsal section of the lateral lobes of the pronotum and lateral sections of the meso-and metanota. Two pairs of oblique, contrasted dark annuli are evident on the caudal femora in the intensive pattern.

The base color ranges from almost uniform fuscous-black, with no distinctive pattern except pale buffy areas on the ventro-caudal sections of the lateral lobes of the pronotum, to clove brown above, with the face, portions of the lateral lobes, pleura and limbs natal brown and army brown to drab and even pale buff, the caudal femora with striking very pale annuli contiguous to the usual dark ones, the caudal tibiae blotched and mottled with fuscous-black. In the greater majority of all the specimens the whole coloration has a "pepper and salt" frosting or ticking. The gray tendency of the base color runs through olive-gray, in its extreme condition with hoary white ventrad on the lateral lobes, on the pleura and considerable of the caudal femora. The red tendency runs to a uniform kaiser brown or, in combination with a maximum development of the dark lateral bars, to naples yellow on the dorsum of the head, thorax and abdomen with the head and limbs washed to a variable degree with dragon's-blood red or pale brick red. Rarely this latter condition has the limbs naples yellow as well as the dorsum of the body. Numerous combinations of the base colors here given are exhibited by the material, but the more striking types have been mentioned.

The most brilliant coloration is exhibited by three females from Roscoe, California, which were taken on *Eriogonum polifolium,* the pink flowers of which were in blossom. These individuals have the dorsum buffy, heavy lateral bars and the limbs reddish to a variable degree. The Del Monte series shows the uniform reddish (kaiser brown) type and the uniform blackish-fuscous type numerous, the broad, continuous, lateral dark bars rarely indicated in adults. The relatively limited material from high elevations (5000 feet upwards) shows no reddish tendency, grayish or blackish tones predominating.

*Distribution.*—The typical form of the species ranges as far north as Paso Robles Hot Springs, in San Luis Obispo County, California, south at least as far as Nellie in the Agua Tibia Mountains, San Diego County, east at least as far as the Cahon Pass, between the San Gabriel and San Bernardino ranges, and the western foot of the San Jacinto Mountains at Coahuila, Riverside County, California. Material from Del Monte, Monterey County is virtually intermediate between *M. c. californica* and *M. c. tamalpaisensis.* The distribution of *M. c. californica* in all probability covers the coast ranges of south-central and southern California and the San Gabriel range, and is known to extend into suitable areas of the lower country. It will, doubtless, be found to occur in the San Bernardino and San Jacinto Mountains, the Cuyamaca Mountains and other ranges of San Diego and Riverside Counties, California, and northern Lower California.

Its vertical distribution extends, in southern California, from as low as 750 to 900 feet at Verdugo, and 825 feet at Roscoe, up to 5200 feet at Nellie and about 5600 feet on Mount Lowe. At Del Monte it occurs but slightly above the sea-level, on what is really a coast shelf. In southern California its occurrence out of the mountains proper appears to be governed by limited areas of suitable environment.

*Biological Notes.*—This interesting form is a chaparral inhabitant, never really abundant, and in actions it is extremely nimble and vigorous. The chaparral components from which it has been taken are: chamisal (*Adenostoma fasciculatum*), manzanita (*Arctostaphylos tomentosa*) and Nuttalls' Ceanothus (*Ceanothus cuneatus*). (See plate XIV, figs. 1 and 2). It has also been taken on *Eriogonum polifolium* in a desert wash at Roscoe (pl. XV, fig. 1). The usual location of the insect is perched in an exposed position on the upper portions of the

bushes, with the caudal limbs strongly diverging and the short antennae erect. Their saltatorial powers are highly developed and they are not at all easy to capture. Constantly on the alert as they are, a swift sweep of the net is the most successful method of securing them.

The earliest date in the year on which, to our knowledge, adults have been taken is August 8 (Mount Lowe and Echo Mountain), and we have seen no specimens taken later than September 27 (Parker Mountain), but the latter date is probably by no means the end of the season of occurrence, as the insect doubtless occurs much later in the year. Immature material taken June 5 (San Gabriel Mountains) is quite small, while that secured August 8 (Mount Lowe) is as far advanced as the second instar preceding maturity. The latest date we have indicated by immature specimens is September 9 to 10 (Del Monte), where we find the two instars preceding maturity represented.

*Morphological Notes.*—The fastigium, when seen from the dorsum, exhibits some variation in its form, width and also in the degree of production, even in individuals of the same sex from the same locality. In some specimens it is more truncate than in the average, and in others it is broader. Features of limb size variation are mentioned under Remarks. The Del Monte series shows a very appreciable amount of variation in the acuteness of the fastigial angle, when seen from the side, but this is due, according to our interpretation, to intergradation through that series with *M. c. tamalpaisensis*. The exact outline of the eye exhibits some variation in the entire series.

*Remarks.*—Typical *Morsea californica californica* is connected with *M. c. tamalpaisensis* by means of the Del Monte series, which averages intermediate in most of its features, although certain specimens are nearly typical *tamalpaisensis*. The form of the male cerci in the Del Monte series is nearly or quite that of *tamalpaisensis*, but the fastigial and antennal forms are, as a whole, intermediate. An examination of the series before us shows a very decided amount of variation in the proportionate length of the limbs, this being particularly evident in the case of the cephalic and median pairs. This tendency is also more decided in the male than in the female sex. In the Del Monte series the extremes are quite evident, while in the southern Californian

representation the elongation is most marked in those from the higher altitudes, *i. e.* 5000 feet or over. There is, however, very considerable variation in the male Echo Mountain individuals taken at 2700 to 3500 feet. For details of the proportions examine the preceding table of measurements.

*Specimens Examined*: 115; 54 ♂, 51 ♀, 10 immature ♀.

California: Del Monte, Monterey County, VIII, 20, 1909, (H.; in chaparral on sandy soil), 9 ♂, 4 ♀, 2 immature ♀: IX, 9–10, 1910, (R. & H.; not uncommon in chaparral, especially on chamisal (*Adenostoma fasciculatum*)), 31 ♀, 26 ♀, 2 immature ♀. Paso Robles Hot Springs, San Luis Obispo County, elevation 900–1100 feet, VIII, 21, 1909, (H.; in chaparral, on *Ceonothus cuneatus*), 1 ♀. Parker Mountain, south-east end of Ventura Range, Los Angeles County, elevation 2800–4100 feet, IX, 27, 1910, (R. & H.; very scarce on slopes), 1 ♂, 1 ♀. Roscoe, Tujunga Wash, Los Angeles County, elevation 825 feet, VIII, 23, 1909, (R. & H.; in part not uncommon on *Eriogonum polifolium*, a bush with dry, pink-white flowers), 2 ♂, 4 ♀. Verdugo, Verdugo Hills, Los Angeles County, elevation 750–900 feet, VIII, 23, 1909, (R. & H.; in high chaparral), 1 ♂, 1 ♀. San Gabriel Mountains, elevation 3500 feet, VI, 5, 1910, (F. Grinnell, Jr.), 1 immature ♀. Mount Wilson, San Gabriel Mountains, Los Angeles County, elevation 5000 feet, IX, 15, 1908, (F. Grinnell, Jr.), 1 ♂, [A. N. S. P.][6] Mount Lowe, San Gabriel Mountains, Los Angeles County, elevation 5200–5600 feet, VIII, 8, 1907, (H.; on bushes of manzanita (*Arctostaphylos tomentosa*)), 2 ♂, 3 ♀, 4 immature ♀, [Hebard Cln. and A. N. S. P.][6]: IX, 25, 1910, (R. & H.; on chamisal (*Adenostoma fasciculatum*) and manzanita (*Arctostaphylos tomentosa*) ), 1 ♂, 1 ♀. Echo Mountain, San Gabriel Mountains, Los Angeles County, elevation 3200 feet, VIII, 8, 1907, (H.), 1 ♀, [Hebard Cln.]: elevation 2700–3500 feet, VIII, 24, 1909, (R.; on chamisal (*Adenostoma fasciculatum*)), 3 ♂, 1 immature ♀: IX, 18, 1910, (R. & H.; occasional on chamisal (*Adenostoma fasciculatum*)), 4 ♂, 6 ♀. Coahuila, Coahuila Valley, Riverside County, VIII, 18, 1914, (J. C. Bradley), 1 ♀, [Cornell Univ.]. Nellie, San Diego County, VIII, 30, 1917, (E. P. Hewlett), 1 ♀, [Hebard Cln.].

**Morsea californica dumicola**[7] new subspecies (Plate XII, figs. 3, 7 and 13; XIII, fig. 3).

This more eastern race differs from typical *Morsea californica* in both sexes in the proportionately narrower, but more regularly rounded, basal outline of the eye, in the less projecting fastigium, in the more clavate distal section of the antennae, which in the two forms are of about equal length, in the more robust and less slender limbs and in the more abbreviate caudal tarsi; in the female sex in addition, in the shorter and broader fastigium, par-

[6] Previously recorded by Rehn and Hebard.

[7] From *dumus*, a thicket, and *incola*, inhabitant.

ticularly when viewed from the dorsum, and in the very much more abbreviate caudal tarsi. From *M. c. tamalpaisensis* the present race differs in much the same features as does *M. c. californica*, its relationship being more distant and in general along antithetical lines.

*Type.*—♂; Prescott, Yavapai County, Arizona. August 21, 1917. (J. August Kusche.) [Hebard Collection, Type no. 481.]

*Description of Type.*—The features given are those diagnostic of this sex of the race.

Angle of fastigium in profile very faintly more acute than a right angle, when seen from the dorsum the fastigium is broader and slightly less projecting than in *M. c. californica:* facial line in profile with no appreciable concavity between fastigial angle and insertion of antennae: eyes broad ovate in basal outline: face slightly broader than in *M. c. californica*: antennae with distal section more depressed and distinctly clavate than in typical *californica.*

Lateral lobes of pronotum slightly deeper in proportion to the length than in *M. c. californica.*

Cerci very faintly more sharply decurved distad than in *M. c. californica*, but of the same type.

Limbs slightly but appreciably shorter and faintly more robust than in the typical form of the species. Caudal tarsi shorter proportionately than in *M. c. californica,* the proximal joint appreciably shorter than the second and third joints combined, the second three-fifths of the length of the third.

Allotype.—♀; same locality as the type. August 24, 1917. (J. August Kusche.) [Hebard Collection.]

*Description of Allotype.*—The characters given are those diagnostic of this sex of the race. Facial angle in profile differing from that of *M. c. californica* in the same ratio as in the male sex (see figure 7); when seen from the dorsum the fastigium is proportionately broader and shorter, the margin less regularly rounded: face less elongate than in female of *M. c. californica.* Eyes in basal outline faintly broader than in the typical form of the species.

Limbs appreciably shorter than in *M. c. californica.* Caudal tarsi but little longer than one-third of the caudal tibiae.

*Paratypic Series.*—We have selected as paratypes forty-three males, and eleven females, taken at Prescott, Arizona, August 21 to 24, 1917, by J. August Kusche.

*Measurements (in millimeters).*—These figures are of maximum and minimum specimens and of others noteworthy for special features.

| ♂ | Length of body | Length of antenna | Length of pronotum | Length of cephalic femur | Length of median femur | Length of caudal femur |
|---|---|---|---|---|---|---|
| Crestline, Nevada | 9 | — | 1.4 | 2 | 1.8 | 7.2 |
| Crestline, Nevada | 10 | 1.9 | 1.5 | 2.2 | 2 | 7.3 |
| Caliente, Nevada | 11.1 | — | 1.5 | 2.2 | 2.1 | 7.8 |
| Prescott, Arizona, *type* | 10.2 | 2.3 | 1.6 | 2.4 | 2.3 | 8.1 |
| Prescott, Arizona, *paratype* | 9.2 | 1.8 | 1.5 | 2.3 | 2.1 | 7.4 |
| Prescott, Arizona, *paratype* | 11.5 | 2.4 | 1.7 | 2.7 | 2.4 | 8.6 |
| Prescott, Arizona, *paratype* | 11 | 2.4 | 1.7 | 2.6 | 2.4 | 8.2 |
| Granite Peak, Arizona | 11.1 | 2.4 | 1.7 | 2.6 | 2.4 | 8.1 |
| Senator, Arizona | 9.7 | 2.3 | 1.5 | 2.6 | 2.2 | 8.1 |
| Senator, Arizona | 10.4 | 2.3 | 1.6 | 2.7 | 2.6 | 8.6 |
| ♀ | | | | | | |
| Crestline, Nevada | 14.5 | 1.8 | 2 | 2 | 1.9 | 8.5 |
| Crestline, Nevada | 16 | 1.7 | 2 | 2.1 | 2.2 | 8.9 |
| Caliente, Nevada | 13.3 | 1.5 | 1.7 | 2.2 | 2.2 | 9 |
| Caliente, Nevada | 14.3 | 1.6 | 2.1 | 2.2 | 2.2 | 9.3 |
| Prescott, Arizona, *allotype* | 17 | 1.9 | 2.1 | 2.4 | 2.3 | 10 |
| Prescott, Arizona, *paratype* | 15 | 1.8 | 1.9 | — | 2.3 | 9.5 |
| Prescott, Arizona, *paratype* | 15 | 1.7 | 2 | 2.5 | 2.3 | 9.3 |
| Prescott, Arizona, *paratype* | 18.5 | — | 2.2 | 2.6 | 2.8 | 10 |
| Granite Peak, Arizona | 17.2 | 1.7 | 2 | 2.3 | 2.2 | 10 |
| Mount Union, Arizona | 18.5 | 2 | 2.1 | 2.6 | 2.6 | 10 |

*Color Notes.*—The material of this race exhibits the same range of color variation found in *M. c. californica*. The base coloration exhibits a more decided tendency toward pinkish buff and pale pinkish buff, and at times even warm buff. The pale tones are more buffy and less reddish than in the typical form of the species. Really dark colored males are seen only in the Crestline series. Several uniformly colored ochraceous-buff and light ochraceous-buff females are in the series, one from Caliente, the other from Prescott, while others from Crestline, Caliente and Prescott approach this condition but have lateral bars indicated to a greater or lesser extent. Females are to a lesser degree blackish than is true in *M. c. californica*, and the "pepper and salt" coloration is less decided in intensity and frequency.

*Distribution.*—This eastern race occurs at localities in the Upper Sonoran Zone in southeastern Nevada and in central Arizona; in the Meadow Valley and Juniper Mountains regions of Lincoln County in the former state, and the Prescott region of Yavapai County in the latter one. It is quite probable it will be found in suitable environments in the intervening country, as conditions at one of the Nevada localities (Crestline) were very similar to those found on the Coconino Plateau region of northern Arizona.

The vertical range of the race is from as low as 4400 feet (Caliente) to at least as high as 6000 feet (Crestline). The upper limit of its distribution in the Prescott region is probably higher than the maximum here given, as Mount Union Peak extends from 6000 feet to practically 8000 feet, but we have no altitudinal information concerning the material from that locality.

*Biological Notes.*—This race is as thamnophilous as the others of this species. At Caliente it occurred on several bushes, one of which was *Kunzia tridentata*, on mountain slopes rising from a wash of Meadow Valley (see plate XVI, fig. 1), while at Crestline it was quite numerous on the same bush growing in open stands of Utah Juniper (*Juniperus utahensis*) and occasional pinyon (*Pinus monophylla*) on the rolling plateau summit of the Juniper Mountains (see plate XVI, fig. 2). Data with certain of the Prescott material show the insect especially preferred thorny bushes in that region.

Apparently this form is represented by immature individuals as late as August 24, but is also adult as early as July 9.

*Morphological Notes.*—The variation in the angle of the fastigium, when seen in profile, is as extensive as in *M. c. californica*, and in the large Prescott series of both sexes this is quite evident. Viewed from the dorsum, however, the characteristically broader and shorter pronotum is less variable.

The material from a relatively high elevation in southern Nevada (Crestline) averages smaller than the central Arizonan series, while that from a lower elevation in the same general region of Nevada in size is more like that from the Arizonan localities.

*Remarks.*—This interesting race is, as far as known, completely isolated in distribution from the other forms of the genus, as we have no knowledge of the occurrence of *Morsea* in any of its races in the extreme desert conditions of western Arizona, southeastern California and the lower or more arid portions of southern Nevada. Its distribution appears to be restricted to portions of the great Arizona plateau region and its northward continuation in southeastern Nevada and probably southern Utah. Its relationship to *M. c. californica* is close and the separation of the two stocks appears to be a relatively recent development.

We believe *M. c. dumicola* is more nearly the primitive stock of the genus, but no demonstrable evidence can be given to support this hypothesis.

*Specimens Examined:* 120; 65 ♂, 49 ♀, 1 immature ♂, 5 immature ♀.

Nevada: Crestline, Lincoln County, elevation 5900–6000 feet, IX, 4, 1909, (R. & H.; quite numerous on *Kunzia tridentata*, growing in open forest of juniper and occasional pinyon), 6♂, 3♀. Caliente, Lincoln County, elevation 4400–5200 feet, IX, 3, 1909, (R. & H.; on mountain slopes rising from wash of Meadow Valley, on several species of bushes, one being *Kunzia tridentata*), 1♂, 4♀.

Arizona: Prescott, Yavapai County, elevation 5200–5600 feet, VII, 9–30, VIII, 5–15, 1917, (O. C. Poling), 1♂, 22♀, 2 immature ♀: VIII, 21–24, 1917, (J. A. Kusche), 51 ♂, 17 ♀, 3 immature ♀, *type*, *allotype*, and *paratypes*, [Hebard Cln.]. Near Granite Peak, vicinity of Prescott, Yavapai County, VIII, 17, 1917, (J. A. Kusche), 1 ♂, 2 ♀, 1 immature ♂, [Hebard Cln.]. Mount Union, Yavapai County, VIII, 15, 1917, (J. A. Kusche), 1 ♀, [Hebard Cln.]. Senator, near Mount Union, Yavapai County, VIII, 11 and 12, 1917, (J. A. Kusche), 5♂, [Hebard Cln.].

**Morsea californica tamalpaisensis** Rehn and Hebard (Plate XII, figs. 4, 8 and 14; XIII, figs. 4 and 11.)

1909. *Morsea californica tamalpaisensis* Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1909, p. 421, figs. 3, 4 and 5. [Mount Tamalpais, Marin County, California.]

This northern race differs from typical *californica* of the Coast Ranges and adjacent region to the southward, and *M. c. dumicola* of Arizona and southern Nevada, in both sexes in the more projecting facial angle (particularly in the male) when seen from the side, in the more acute dorsal and ventral angles of the basal eye outline, in the slightly broader and more projecting fastigium (particularly in the male) when seen from the dorsum, in the proportionately deeper infra-ocular portion of the genae, in the more elongate and more spatulate antennae and in the more ample pronotum, while in the male the lateral lobes of the pronotum are proportionately deeper, and the cerci of the same sex are more incrassate and more sharply hooked distad. In immature specimens the differential features, particularly of the fastigium, are less clearly indicated than in adults.

*Type.*—♂; Mount Tamalpais, Marin County, California. Elevation 2100 feet. August 23, 1907. (M. Hebard.) [Hebard Collection, Type no. 12.]

*Allotype.*— ♀ ; Same data as type. [Hebard Collection.]

The differential characters of this race are given above in the comparative diagnosis.

*Paratypic Series.*—Ten adult males, one adult female and four immature females, all from Mount Tamalpais, August 23, 1907, taken at 1500 and 2100 feet, (M. Hebard), [Hebard Collection and Acad. Nat. Sci. Phila.].

*Measurements (in millimeters).*—These measurements are of maximum and minimum specimens and of others noteworthy for special features.

| ♂ | Length of body | Length of antenna | Length of pronotum | Length of cephalic femur | Length of median femur | Length of caudal femur |
|---|---|---|---|---|---|---|
| Mount Tamalpais, California, *type* | 10.2 | 2.5 | 1.8 | 3.1 | 2.7 | 8.2 |
| Mount Tamalpais, California | 10.9 | 2.8 | 1.6 | 2.7 | 2.5 | 8 |
| Mount Tamalpais, California, *paratype* | 10.5 | 2.5 | 1.8 | 3.1 | 2.7 | 8.7 |
| Mount Tamalpais, California | 10.5 | 2.8 | 1.7 | 3.1 | 2.7 | 8.5 |
| ♀ | | | | | | |
| Mount Tamalpais, California, *allotype* | 14 | 1.8 | 2.1 | 2.7 | 2.6 | 9.5 |
| Mount Tamalpais, California | 14.4 | — | 2 | 2.5 | 2.5 | 9 |
| Mount Tamalpais, California | 15.5 | 2.3 | 2.1 | 2.8 | 2.8 | 10 |
| Mount Tamalpais, California | 17.5 | 2.3 | 2.1 | 2.8 | 2.7 | 10.1 |

*Color Notes.*—When compared with *M. c. californica* the series of the present race is seen to show no individuals with solid or complete dark lateral bars, these being indicated but in part and elsewhere lost in the generally more dark grayish color of the specimens. The males run through hair brown, mouse grays, olive grays and fuscous, with relatively weak contrasts, rarely the dorsum is hoary and occasionally brick red or kaiser brown. The females are occasionally uniform blackish, but the majority are uniform kaiser brown to ochraceous-buff.

*Distribution.*—This geographical race is known only from Mount Tamalpais, at elevations of from 1500 to 2586 (summit) feet. Its range doubtless covers other mountainous areas in the general vicinity of San Francisco Bay, which are of sufficient elevation to carry the required habitat conditions. As shown

under *M. c. californica*, Del Monte material is practically intermediate between the two subspecies.

*Biological Notes.*—The Tamalpaisan form frequents the thick, low chaparral from 1100 to 1500 feet elevation and the heavier, more arborescent chaparral from 1500 feet to the summit (2586 feet) of Mount Tamalpais (see plate XV, fig. 2). The principal components of this chaparral are chamisal (*Adenostoma fasciculatum*) and manzanita (*Arctostaphylos glandulosa*), on both of which *Morsea* occurs as commonly and as vigorous and active as in southern California. The majority of those taken were beaten at 2400 feet. From the data before us it would be fair to assume that the first individuals reach maturity some time before August 17, the earlier of the two dates represented, and also that the form persists well into September at least, as immature specimens were taken on August 23.

*Morphological Notes.*—This race exhibits form variation much of the same character as found in typical *californica*. When seen from the dorsum the fastigium varies quite appreciably in width and in relative degree of production. There is a considerable amount of variation in the antennal length and also in the degree of spatulation and acuteness of the apex.

*Remarks.*—We have discussed under *M. c. californica* the intergradation of the present race and the typical form of the species, as demonstrated by the Del Monte series. The present northwestern extreme development of the genus is clearly a derivative from *M. c. californica*, its intergradation with the latter, its geographic position at the periphery of the generic distribution and away from the center of development of the subfamily in America, and also from the optimum development of the specific entity, make its origin apparent.

*Specimens Examined:* 63; 39 ♂, 12 ♀, 12 immature ♀.

California: Mount Tamalpais, Marin County, elevation 1100–2586 feet, VIII, 17, 1909, (R. & H.; in chaparral of chamisal and manzanita), 28 ♂, 10 ♀, 8 immature ♀: elevation 1500–2100, VIII, 23, 1907, (H.; on chamisal and manzanita), 11 ♂, 2 ♀, 4 immature ♀, *type, allotype* and *paratypes*. [Hebard Cln. and A. N. S. P.].

**PSYCHOMASTAX**[8] new genus

A striking new genus related to *Masyntes* Karsch and *Morsea* Scudder, more nearly related to the latter, but having some important features resembling those of *Masyntes*. The genus is characterized chiefly by its relatively robust, apterous form; the distinct fastigium, which is but moderately produced; the weakly convex facial line; the broad frontal costa, somewhat broader dorsad; pronotum ample, with caudal margin of disk emarginate mesad; the lateral lobes of pronotum deep, rounded (♂) or sharply rectangulate (♀) at the ventro-caudal angle; ovipositor jaws of normal type; male cerci simple, styliform and subgenital segment of the male composed of three parts.

From *Masyntes* (genotype, *M. gundlachi*) the present genus can be distinguished by the uniseriate character of the spine series on the dorsal margins of the caudal tibiae (in this resembling *Morsea*), the less produced and less elongate (dorso-ventrad) head, in the broad but shallowly excavate frontal costa, in the cylindrically incrassate distal half of the antennae, in the rectangulate (♂ and ♀) fastigio-facial angle when seen from the side, in the deep, corcelet-like pronotum (which *Morsea* more nearly approaches), the caudal margin of the disk of which is emarginate and not produced or truncate as in *Masyntes*, in the absence of tegmina and wings (in this respect similar to *Morsea*), in the interspace between the mesosternal lobes being approximately twice as wide as the lobes themselves (instead of but little wider), in the simpler and more normal ovipositor jaws, and in the simple, styliform cerci of the male.

From *Morsea* (genotype, *M. californica*) the new genus differs in the robust and less attenuate form, the shorter and broader head, the rectangulate fastigio-facial angle when seen from the side, in the broader and simpler fastigium when seen from the dorsum, in the much broader and more shallowly excavate, as well as in general more subequal, frontal costa, in the antennal tooth being present on the ninth segment, in the ventro-caudal angle of the lateral lobes of the pronotum being distinctly angulate in the female, in the simple styliform cerci of the male, in the absence of a linguiform process on the dorsal section of the subgenital segment of the same sex.

[8] From ψυχη *spirit*, and *Mastax*.

As a whole *Psychomastax* appears to be a generalized member of the genera group to which *Morsea* and *Masyntes* belong, not as specialized in numerous points of structure as *Morsea*, and also well distinct from *Masyntes*. Superficially there is quite a little resemblance to *Episactus*, particularly in the general form, outline of head, and other features, but more than superficial examination of the two genera shows they have no real relationship.

Genotype.—*Psychomastax psylla* new species.

**Psychomastax psylla**[9] new species (Plate XI, fig. 1; XII, figs. 1, 5, 9, 11, 15, 17 and 19; XIII, figs. 1, 5, 7 and 9.)

*Type.*—♂; Strawberry Valley, San Jacinto Mountains, Riverside County, California. Elevation, 6500 to 7500 feet. August 27, 1909. (J. Rehn; in spiny chaparral.) [Hebard Collection, Type no. 474.]

Size small: form apterous, elongate subfusiform, abdomen subcompressed: surface not polished, on the thorax and abdomen with numerous, small, subobsolete strumosities.

Head with its dorsal length not more than four-fifths of that of the disk of the pronotum; occiput arcuate, ascendent to the vertex, which is plane with the fastigium, the occiput, vertex and fastigium with a weak but continuous medio-longitudinal carinulation, the vertex regularly narrowing to the fastigium, which projects but little cephalad of the eyes, in width it is relatively broad, subequal to one-half the dorsal width of one of the eyes, the cephalic margin truncate, the lateral angles very narrowly rounded, the cephalic and lateral margins of the fastigium cingulato-carinulate, these elevations extending caudad around the internal margin of the eyes: fastigio-facial angle rectangulate when seen from the side; facial line regularly arcuate when seen from the side, decidedly retreating; frontal costa relatively broad, subequal except that it slightly widens dorsad a short distance ventrad of the fastigio-facial angle and is also weakly constricted a short distance ventrad of the ocellus, V-sulcate except in the widened dorsal portion, where the floor of the costa is broadly elevated within its margins; lateral facial carinae prominent, subparallel ventrad of the eyes, continued around the cephalic margin of the eyes as similar ridges which reach to the fastigium: eyes large, prominent, in depth nearly twice that of the infra-ocular portion of the genae, oval in basal outline: antennae no longer than the depth of the face, composed of twelve articles, the six proximal joints approximately subequal in length, those distad shortened, distal half of the antenna weakly inerassate and subdepressed, apex blunt, tooth on ventral surface of ninth segment.

Pronotum of normal type, expanding caudad, no distinct dorso-lateral carinae present, medio-longitudinal carinulation weak but continuous; no transverse sulci present; cephalic margin of disk weakly arcuate, caudal mar-

[9] A flea, in allusion to the jumping ability of the species.

gin weakly bisinuate with a broad, shallow, median emargination; caudal width of the entire pronotum slightly greater than the length of the same: lateral lobes of the pronotum with their greatest depth equal to about two-thirds of their dorsal length, dorsal half of the lobes with a group of numerous small strumosities, the ventro-caudal section of the lobes flaring laterad, the ventro-cephalic section slightly curved ventro-mesad; cephalic margin of the lobes regularly arcuate to the ventro-cephalic angle, which is broadly rounded and passes into the truncate ventral margin, ventro-caudal angle rounded rectangulate, caudal margin subtruncate. Tegmina and wings absent. Mesonotum reproducing the structure of the caudal section of the pronotum; metanotum more similar to the abdominal segments in structure, the caudal margin more nearly truncate, median carinulation evident.

Abdomen with the median carinulation continuous to the disto-dorsal abdominal segment, on which it is not evident: disto-dorsal abdominal segment with its distal margin faintly arcuate mesad, arcuate-emarginate about the cercal bases: cerci relatively short, not quite reaching the extremity of the subgenital plate, simple, tapering styliform, faintly incurved, apex blunted: supra-anal plate trigonal, with a median carination: subgenital plate or rather segment apparently composed of a pair of lateral plates with the section between made up of soft integument, the plates elongate trigonal in form, the apices, which are dorsal, acute, the whole plate when seen from the caudal aspect in section regularly arcuate toward the median line, the tips of the two plates or sections attingent; the integument median and ventro-caudal in position, its general outline subtrigonal when seen from the caudal aspect; when seen from the lateral aspect the subgenital plate or segment is distinctly deeper than long, when seen from the caudal aspect with the width is faintly greater than the depth. Interspace between the mesosternal lobes strongly transverse, approximately twice as wide as one of the lobes, the cephalic margin of the interspace very broadly obtuse-angulate emarginate, the internal margins of the lobes slightly oblique, the interspace broadening caudad, the interno-caudal angle of the lobes nearly rectangulate: metasternal lobes contiguous, the caudal margin of the meso-metasternal plate broadly obtuse-angulate emarginate.

Cephalic and median limbs slender. Caudal femora moderately elongate, slender, in length subequal to that of the thorax and abdomen combined, tapering, weakly compressed, median dorsal carina minutely serrulate; pagina flattened, pattern distinct but slightly irregular; margin of the genicular extremity with median and lateral spiniform projections, genicular lobes acute: caudal tibiae very faintly longer than the femora, weakly sinuate; spines not regularly biseriate in length, decreasing in length proximad, external margin with fifteen spines, internal margin with thirteen to fourteen spines, of which the distal one is shorter than the others and rather removed from the series, being placed on the distal lamellation of that margin: tibial spurs of the external face short, the dorsal one about twice as long as the ventral one, the former about equal to the distal tibial depth, spurs of the internal face unequal in length, the dorsal one nearly three times the length of the ventral one, the length equal to about two-fifths that of the caudal metatarsus, the distal por-

tion of the dorso-internal spur slightly curved: caudal tarsi slender, in length equal to about two-fifths that of the caudal tibiae; metatarsus equal to one-half the tarsal length, with three pulvilli, one proximal, one post-median and one distal; second joint relatively elongate, but little less than half as long as the metatarsus; arolium large.

*Allotype.*— ♀ ; Same data as type. [Hebard Collection.]

*Description of Allotype.*—Differing from the description of the type in the following features.

Size larger than male: abdominal strumosities more localized proximad.

Head with dorsal length equal to two-thirds of length of pronotal disk; fastigium quite broad, in width subequal to the dorsal width of one of the eyes, extending cephalad of the eyes a distance equal to one-third of the greatest fastigial width, caudal continuations of marginal carinulae of fastigium less decided than in male: frontal costa proportionately broader than in male, margins somewhat more sinuate but of same general form, sulcation more rounded, dorsal portion of costa more decidedly elevated within its margins than in male: eyes less prominent than in male, in depth slightly greater than the infra-ocular portion of the genae, in outline more angulate dorsad and ventrad than in male: antennae short, distinctly shorter proportionately than in male, fourth and remaining joints distad somewhat more elongate than first to third joints.

Pronotum with medio-longitudinal carinulation marked but not greatly elevated; caudal margin of pronotal disk hardly emarginate mesad: lateral lobes of pronotum with ventral margin more oblique than in male, caudal margin sigmoid.

Abdomen more compressed than in male; dorsal carina continuous and marked to supra-anal plate: ovipositor jaws moderately produced, dorsal pair with the dorso-external margin serrulate except near the acute apex, ventral valves with distal section regularly arcuate with the apex acute: subgenital plate with distal margin produced mesad, between the ovipositor valves, into a spiniform process, strongly arcuate-emarginate laterad of this. Interspace between the mesosternal lobes less strongly transverse, the width equal to one and two-thirds the width of one of the lobes: metasternal lobes narrowly separated, the foveolae separate and oblique.

Caudal femora in length equal to about two-thirds that of the abdomen: caudal tibiae with fourteen to eighteen spines on external margin, internal margin with fourteen to fifteen spines.

*Paratypic Series.*—We have before us four adult male, two adult female and one immature male paratypes bearing the same data as the type and allotype. In addition to these we have a female paratype from Coahuila, Riverside County, California.

*Measurements (in millimeters)*

| ♂ | Length of body | Length of antenna | Length of pronotum | Length of cephalic femur | Length of median femur | Length of caudal femur |
|---|---|---|---|---|---|---|
| Strawberry Valley, California, *type* | 10.8 | 2.4 | 1.8 | 2.6 | 2.7 | 8 |
| Strawberry Valley, California, *paratype* | 9.6 | 2 | 1.7 | 2.4 | 2.3 | 7.9 |
| Strawberry Valley, California, *paratype* | 9.7 | 2.2 | 1.9 | 2.6 | 2.5 | 7.2 |
| ♀ | | | | | | |
| Strawberry Valley, California, *allotype* | 17.2 | 2 | 2.5 | 2.8 | 2.8 | 9.5 |
| Strawberry Valley, California, *paratype* | 16 | 1.9 | 2.3 | 2.6 | 2.6 | 8.5 |
| Strawberry Valley, California, *paratype* | 18 | 2 | 2.6 | 2.7 | 2.8 | 9.6 |
| Coahuila, California, *paratype* | 18.1 | 2 | 2.5 | 2.7 | 2.7 | 9.9 |

*Color Notes.*—General dorsal coloration of male varying from dark olive-brown to wood brown, passing to buffy brown on dorsum of abdomen. In the same sex the face, ventral, or at least ventro-cephalic, portion of the lateral lobes and pleura are light ochraceous-buff to light ochraceous-salmon, rarely this area on the thoracic segments is more tawny than the face. Irregularly defined broad lateral postocular bars of blackish fuscous are indicated on the head, pronotum and mesonotum, these frequently incomplete or merely outlined on the lateral lobes of the pronotum. Sterna of the male sex tawny to dresden brown, passing to isabella color on the venter of the abdomen. Cephalic and median limbs of male tawny, mottled with mummy brown to nearly clear ochraceous-tawny, with faint tibial mottlings. Caudal femora of male dull tawny to clear tawny, heavily yet obscurely triannulate with fuscous; caudal tibiae honey-yellow to olive-ocher, clouded to a variable degree with fuscous, darker distad, spines black tipped.

General coloration of female ranging from prout's brown, mottled with a heavy yet poorly defined overcasting of mummy brown, through a dull chestnut brown phase to one with its whole coloration olive-ocher. One female paratype has the face and the dorsal surface of the thorax, abdomen and caudal femora pale chartreuse yellow, the lateral aspects and remainder of the body snuff brown to bister, the latter on the dorso-lateral lines of demarcation. Faint traces of the dark postocular bars of the male are noticeable in all the females except the uniformly pale form. In the female sex the barring of the caudal femora is obscurely indicated. The caudal tibiae are mottled as in the male in all but the bicolored specimen, which has them uniform clay color, the spines black tipped. The pale female has all the femora appreciably but indefinitely barred, as described in the male sex. Eyes of both sexes cinnamon-brown and dresden brown, mottled and sprinkled with fuscous. Antennae of both sexes buckthorn brown to mars brown.

*Distribution.*—This interesting genus and species is known from only two localities, Strawberry Valley, San Jacinto Mountains,

and Coahuila, both in Riverside County, California, and in an air-line but a relatively few miles distant from one another.

*Biological Notes.*—In the San Jacinto Mountains this species was found in an area of Upper Sonoran spiny chaparral, at an elevation of between 6500 and 7500 feet, on the south facing slope of a hog-back ridge southeast of Strawberry Valley, a location where the valley itself and surrounding slopes were covered with Transition pine forests. The area in which it was found has been correctly mapped by Hall[10] and Grinnell and Swarth,[11] in studying respectively the plants and vertebrates of the range. The species was not at all abundant and the material taken was secured only by persistent search, in situations where beating was impossible and sweeping difficult. The species apparently persists well into the month of September, as the presence of one immature female would indicate.

*Morphological Notes.*—The only noteworthy variational features which are evident from the series are in the female sex. The caudal margin of the pronotal disk varies from the type described to one in which the margin is almost straight transverse. The frontal costa in the same sex may show no widening between the antennal bases, or it may have the marked dorsal expansion continuous and evident as far ventrad as the median ocellus. This latter condition occurs in the single Coahuila female. In the male sex there is a very faint indication of a similar variation, but it is not as evident as in the female sex. The number of teeth on the ventro-external margin of the ovipositor jaws varies to as many as six, occasionally differing in the paired jaws.

*Remarks.*—This interesting genus and species is very similar to *Morsea* in habitat and actions, and the two were taken at the same locality (Coahuila), although it is quite probable in different situations. Our information is, however, so limited we can formulate no warranted generalizations regarding the insect.

*Specimens Examined*: 10; 5 ♂, 4 ♀, immature ♀.

California: Strawberry Valley, San Jacinto Mountains, Riverside County, elevation 6500–7500 feet, VIII, 27, 1909, (R.; in spiny chaparral), 5 ♂, 3 ♀, 1 immature ♀, *type, allotype* and *paratypes*. Coahuila, Riverside County, VIII, 18, 1914, (J. C. Bradley), 1 ♀, *paratype*.

[10] A Botanical Survey of San Jacinto Mountain, Univ. of Cal. Publ., Botan., i, pl. 2, (1907).

[11] Univ. of Cal. Publ., Zoöl., x, no. 10, pl. 6, (1913).

## EXPLANATION OF PLATES

### Plate XI

Fig. 1.—*Psychomastax psylla* new genus and species. Lateral view of male (*type*). (× 7)

Fig. 2.—*Morsea californica californica* Scudder. Lateral view of male. Mount Lowe, California. (× 6)

### Plate XII

Fig. 1.—*Psychomastax psylla* new genus and species. Lateral view of head and pronotum of male (*type*). (× 5)

Fig. 2.—*Morsea californica californica* Scudder. Lateral view of head and pronotum of male. Mount Lowe, California. (× 5)

Fig. 3.—*Morsea californica dumicola* new subspecies. Lateral view of head and pronotum of male (*type*). (× 7)

Fig. 4.—*Morsea californica tamalpaisensis* Rehn and Hebard. Lateral view of head and pronotum of male (*type*). (× 6)

Fig. 5.—*Psychomastax psylla* new genus and species. Lateral view of head and pronotum of female (*allotype*). (× 7)

Fig. 6.—*Morsea californica californica* Scudder. Lateral view of head and pronotum of female. Mount Lowe, California. (× 7)

Fig. 7.—*Morsea californica dumicola* new subspecies. Lateral view of head and pronotum of female (*allotype*). (× 6)

Fig. 8.—*Morsea californica tamalpaisensis* Rehn and Hebard. Lateral view of head and pronotum of female (*allotype*). (× 6)

Fig. 9.—*Psychomastax psylla* new genus and species. Dorsal outline of antenna of male (*type*). (Greatly enlarged.)

Fig. 10.—*Morsea californica californica* Scudder. Dorsal outline of antenna of male. Mount Lowe, California. (Greatly enlarged.)

Fig. 11.—*Psychomastax psylla* new genus and species. Dorsal view of head and pronotum of male (*type*). (× 5).

Fig. 12.—*Morsea californica californica* Scudder. Dorsal view of head and pronotum of male. Mount Lowe, California. (× 5)

Fig. 13.—*Morsea californica dumicola* new subspecies. Dorsal view of head and pronotum of male (*type*). (× 7)

Fig. 14.—*Morsea californica tamalpaisensis* Rehn and Hebard. Dorsal view of head and pronotum of male (*type*). (× 6)

Fig. 15.—*Psychomastax psylla* new genus and species. Outline of cephalic aspect of head of male (*type*). (× 6)

Fig. 16.—*Morsea californica californica* Scudder. Outline of cephalic aspect of head of male. Mount Lowe, California. (× 5)

Fig. 17.—*Psychomastax psylla* new genus and species. Dorsal outline of apex of abdomen of female (*allotype*). (× 5)

Fig. 18.—*Morsea californica californica* Scudder. Dorsal outline of apex of abdomen of female. Mount Lowe, California. (× 7)

Fig. 19.—*Psychomastax psylla* new genus and species. Lateral outline of apex of abdomen of female (*allotype*). (× 5)

Fig. 20.—*Morsea californica californica* Scudder. Lateral outline of apex of abdomen of female. Mount Lowe, California. (× 7)

## Plate XIII

Fig. 1.—*Psychomastax psylla* new genus and species. Dorsal view of head and pronotum of female (*allotype*). (× 8)

Fig. 2.—*Morsea californica californica* Scudder. Dorsal view of head and pronotum of female. Mount Lowe, California. (× 7)

Fig. 3.—*Morsea californica dumicola* new subspecies. Dorsal view of head and pronotum of female (*allotype*). (× 8)

Fig. 4.—*Morsea californica tamalpaisensis* Rehn and Hebard. Dorsal view of head and pronotum of female (*allotype*). (× 8)

Fig. 5.—*Psychomastax psylla* new genus and species. Outline of cephalic aspect of head of female (*allotype*). (× 7)

Fig. 6.—*Morsea californica californica* Scudder. Outline of cephalic aspect of head of female. Mount Lowe, California. (× 7)

Fig. 7.—*Psychomastax psylla* new genus and species. Dorsal view of apex of abdomen of male (*type*). (Greatly enlarged.)

Fig. 8.—*Morsea californica californica* Scudder. Dorsal view of apex of abdomen of male. Mount Lowe, California. (Greatly enlarged.)

Fig. 9.—*Psychomastax psylla* new genus and species. Lateral view of apex of abdomen of male (*type*). (Greatly enlarged.)

Fig. 10.—*Morsea californica californica* Scudder. Lateral view of apex of abdomen of male. Mount Lowe, California. (Greatly enlarged.)

Fig. 11.—*Morsea californica tamalpaisensis* Rehn and Hebard. Lateral view of apex of abdomen of male (*type*). (Greatly enlarged.)

## Plate XIV

Fig. 1.—High slopes of San Gabriel Mountains, Los Angeles County, California. View northward from summit of Mount Lowe. Upper portion of region frequented by *Morsea californica californica*. (Photograph by Rehn and Hebard.)

Fig. 2.—Middle slopes of San Gabriel Mountains, Los Angeles County, California. Looking down on Echo Mountain and the lower country about Pasadena. Typical habitat of *Morsea californica californica* in the middle portion of its vertical range. Vegetation largely composed of chamisal (*Adenostoma fasciculatum*) and manzanita (*Arctostaphylos*). (Photograph by Rehn and Hebard.)

## Plate XV

Fig. 1.—Tujunga Wash, at Roscoe, Los Angeles County, California. Looking toward the Verdugo Hills and, in the distance, the San Gabriel Mountains. Area of extension of range of *Morsea californica californica* along a tongue of suitable environment projecting into the lower country. (Photograph by Rehn and Hebard.)

Fig. 2.—Chaparral on upper slopes of Mount Tamalpais, Marin County, California. Habitat of *Morsea californica tamalpaisensis*. Chief components of this chaparral are chamisal (*Adenostoma fasciculatum*) and manzanita (*Arctostaphylos*). (Photograph by Rehn and Hebard.)

## Plate XVI

Fig. 1.—Slopes at Caliente, Lincoln County, Nevada. Walls of lateral canyon of Meadow Valley. Habitat of *Morsea californica dumicola*. (Photograph by Rehn and Hebard.)

Fig. 2.—Environment at Crestline, Lincoln County, Nevada. Vegetation chiefly sage and Utah Juniper (*Juniperus utahensis*). Habitat of *Morsea californica dumicola* at upper limit of its distribution. (Photograph by Rehn and Hebard.)

## A RARE COLEOPTERA PAPER OF T. W. HARRIS

BY GEORGE M. GREENE

Since beginning the compilation of a verified catalog of North American Coleoptera (October 24th, 1901), the author, being a resident of Philadelphia, has done most of the work at the Academy of Natural Sciences. Occasionally I could not find a paper or work and the majority of those wanting I found in Washington, D. C., on my periodical visits there. I have finally reached the conclusion that it is, indeed, a rare book on entomology (especially the older ones) that is not in the Academy building (which also houses the library of The American Entomological Society). To date I know of only three that are not to be found in libraries in North America.

I have recently had the opportunity to check some descriptions not verified before, and in doing so it was necessary to refer to a certain rare publication, which I thought worth while to transcribe for the Coleopterists less fortunate than one who is able to examine the original. For those who can use this in the future it can be found in the Congressional Library QH1N335.[1]

It is a small volume, the title page of which reads: "Transactions of the Natural History Society of Hartford. Number One. Printed for the Society. Hartford: Case, Tiffany & Co., Printers. MDCCCXXXVI." I believe one volume only was published.

With the exception of two letters, the first sixty-four pages are taken up with "An Address to the Citizens of Hartford, on the Birth-day of Linnæus: May 24th, 1836. In behalf of the objects of the Natural History Society; formed October 8, 1835." By Samuel Farmar Jarvis, D. D.

On page 65 appears: "Characteristics of some previously described North American Coleopterous Insects, and descriptions of others which appear to be new, in the Collection of Mr. Abraham

[1] Since writing the above I have secured a copy of this which had the plate missing—a photograph was made from the one in Washington and the complete volume is now in the library of The American Entomological Society.

Halsey: By T. W. Harris, M. D., Librarian of Harvard University. Communicated Dec. 23, 1835," which concludes the volume.

In this are described twenty-seven species of which twelve, Nos. 8, 12, 13, 14, 17, 18, 19, 20, 21, 22, 24 and 27, are new. Following is a résumé, including synonyms and notes as given and complete descriptions of those new. Parenthetical remarks after each species are mine.

Page 65. "1. CLIVINA QUADRIMACULATA, *Pal. de Beauvois. Scarites (Clivina) quadrimaculata, Palisot de Beauvois.*—Insectes, p. 107. Pl. 15, fig. 6. *Clivina bipustulata ? F. var. Say.* Trans. Philos. Soc. Phil. N. S. vol. ii. p. 20–21. *C. bipustulata, F. Dejean.* Species. Vol. i. p. 417. *C. quadrimaculata, Pal. de Beauv. Say.* Descriptions, Harmony. p. 5.—Trans. Philos. Soc. Phil. N. S. vol. iv. p. 415. *Halsey's Collection,* No. 11." (This is 275 [Henshaw], *Clivina bipustulata* Fabr.)

Page 66. "2. CLIVINA SPHÆRICOLLIS, *Say. C. sphæricollis, Say.* Trans. Philos. Soc. Phil. N. S. vol. ii. p. 23. *Halsey's Collection,* No. 10. Must belong to M. Bonelli's genus DYSCHIRIUS." (This is 237 [Henshaw], *Dyschirius sphæricollis* Say.)

Page 67. "3. CHLÆNIUS ÆSTIVUS ? *Say. C. æstivus ? Say.* Trans. Philos. Soc. Phil. N. S. vol. ii. p. 62. *Halsey's Collection,* No. 16. Two females." (This is 1003 [Henshaw], *C. æstivus* Say.)

Page 67. "4. COLYMBETES STAGNINUS, *Say. C. stagninus, Say.* Trans. Philos. Soc. Phil. N. S. vol. ii. p. 100. *Halsey's Collection,* No. 38, 1 female." (This is 1417 [Henshaw], *Agabus stagninus* Say.)

Page 68. "5. COLYMBETES GLYPHICUS, *Say. C. glyphicus, Say.* Trans. Philos. Soc. Phil. N. S. vol. ii. p. 99. *Halsey's Collection,* No. 39. One male." (This is 1402 [Henshaw], *Copelatus glyphicus* Say.)

Page 69. "6. OXYTELUS RUGULOSUS ? *Say. O. rugulosus ? Say.* Descriptions, Harmony. p. 47.—Trans. Philos. Soc. Phil. N. S. vol. iv. p. 460. *Halsey's Collection,* No. 46." (This is 2750 [Henshaw], *O. rugosus* Fabr.)

Page 70. "7. TACHYPORUS MŒSTUS, *Say. T. mæstus, Say.* Descriptions, Harmony. p. 53.—Trans. Philos. Soc. Phil. N. S. vol. iv. p. 466. *Halsey's Collection,* No. 202." (This is 2648 [Henshaw], *Conosoma crassum* Grav.)

Page 70. "8. ELATER MILITARIS. Plate I, fig. 1.

"Black; elytra whitish, outer edge and elongated sutural spot behind black.

"Length 30 hundredths of an inch.

"*Halsey's Collection,* No. 58.

"Body black. Clypeus moderate, depressed, rounded at tip. Antennæ piceous, not much longer than the thorax, not very robust; second and third joints obconical, nearly globular, much smaller than either of the succeeding ones; the second rather shorter and thicker than the third; the fourth and remaining joints to the last triangular, and equal; terminal joint regularly oval. Thorax short, and with the head minutely punctured, polished, black; hairs

thin, inconspicuous; posterior angles carinated, very slightly excurved, acute. Scutel convex, acute and slightly elevated behind. Elytra whitish, with striæ of dilated punctures; the exterior edge black, and an elongated black spot upon the suture, widest behind, and suddenly attenuated before the middle, extending in a mere line [page 71] nearly to the scutel. Feet piceous; tarsal joints progressively shorter and smaller to the last, not lobed beneath; claws simple.

"This apparently new species nearly resembles the *lugubris* of M. Pal. de Beauvois in form; but it is a much smaller insect; the thorax is more polished, with the punctures less apparent, the hinder margin not so deeply emarginated for the base of the elytra, and the posterior angles rather more excurved. The elytra, taken together, are widest just before the middle, and are not so much contracted until towards the tip. The antennæ and tarsi are widely different in these two species." (This is 4231 [Henshaw], *E. militaris* Harris.)

Page 71. "9. Elater rubricollis, *Herbst. E. rubricollis, Herbst.* Käfer. vol. x. p. 49, Plate 162, fig. 6. *E. rubricollis, Melsheimer's Cat. Say.* Journ. Acad. Nat. Sciences, Phil. vol. iii. p. 177. *E. verticinus, Beauvois, Say.* Annals Lyceum, New York, vol. i. p. 268. *E. rubricollis, Herbst, Say.* Descriptions, Harmony. p. 71. *Cabinet of the Boston Society of Nat. Hist.* No. 918. [Page 72.] From New Hampshire. Inhabits New Hampshire, Pennsylvania, and Illinois." "It is, without doubt, the true *rubricollis* of M. Herbst. Mr. Say[3] says that 'it is the *verticinus*, Beauvois,' also, and that he 'does not know which [name] has the priority.'[4] It is not to be found described in the 12 *livraisons* of M. Pal. de Beauvois's 'Insectes,' the last of which was published in 1818; and as Herbst published the 10th volume of his work in 1806, the name *rubricollis*, given by him, has undoubtedly the priority, over that of *verticinus*." (This is 4229 [Henshaw], *E. rubricollis* Herbst.)

Page 72. "10. Eucnemis triangularis, *Say.* [Page 73] *Elater triangularis*, Say. Journ. Acad. Nat. Sc. vol. iii. p. 170. *Eucnemis*[5] *triangularis*, Say. Ms. No. 13. *Eucnemis longulus, Dejean*, according to Leconte. *Halsey's Collection*, No. 69. Inhabits New Hampshire, Indiana, Missouri, &c. The variety, indicated, in the Journal Academy Nat. Sc., as having the elytra striated and dull rufous at base, has been separated and described as a distinct species, in Mr. Say's Manuscripts, under the name of *Eucnemis humeralis*. Besides these two species, Mr. Say refers to the [page 74] same genus his *Elaters muscidus, unicolor*, and *clypeatus*, his *Melasis ruficornis*, and eight new species, inhabiting the United States." (This is a misidentification = 4050 [Henshaw], *Microrhagus subsinuatus* LeC.)

Page 74. "11. Lampyris nigricans, *Say. L. nigricans, Say.* Journ. Acad. Nat. Sc. vol. iii. p. 179. *Halsey's Collection*, No. 77a." (This is 4818 [Henshaw], *Lucidota nigricans* Say.)

[3] Annals New York Lyceum, vol. i. p. 268, under *E. collaris*.

[4] See his "Descriptions of new species of North American Insects, &c." printed at Harmony, Indiana, from 1829 to 1834, p. 71.

[5] This is correct—*Eucnemis* not *Eucnemis*. (G. M. G.)

Page 74. "12. Lampyris decipiens. Plate I, fig. 2.

"Brownish black or fuscous; lateral dilated margins of the thorax rosaceous, or sanguineo-rufous; tip of the abdomen immaculate.

"Length from 22 to 26 hundredths of an inch.

"*L. decipiens, Harris,* Catalogue, p. 500.

"*Halsey's Collection,* No. 77.

"Body oblong, nearly linear, brownish black, opaque. Antennæ nearly linear, slightly dilated and subcompressed; terminal almost as long as the penultimate joint, linear, obtuse at tip. Thorax polished black from the base to the front edge, the dilated and depressed lateral margins above and beneath rosaceous in recent and sanguineo-rufous in old specimens. Elytra brownish black, opaque, minutely granulated, and with two slightly elevated lines. Abdomen entirely black beneath.

"Inhabits Massachusetts."

[Page 75] "Differs from *L. nigricans* in not having the lateral margin as well as the disc of the thorax black, in the form of the last joint of the antennæ, &c. &c. It somewhat resembles *L. laticornis,* Fabricius, a much larger and proportionally broader species, which has more dilated antennæ, and the sides of the last abdominal segment yellowish white both above and beneath." (This is 4820 [Henshaw], *Lucidota decipiens* Harris.)

Page 75. "13. Anobium peltatum.

"Reddish brown, sericeous; thorax transverse, obsoletely carinated in the middle of the base; elytral striæ impunctured, slender, not profound.

"Length from 17 to 18 hundredths of an inch.

"*Halsey's Collection,* No. 221, male and female.

"Last three joints of the antennæ in the male oblong-oval, not much elongated; remaining joints triangular, dilated, serrate. In the female the joints of the antennæ are proportionally shorter than those of the male, the two or three basal ones transverse, the rest progressively longer but all triangular, except the last, which is oblong-oval. Thorax transverse, not abruptly contracted before, basal edge slightly bisinuated, basal angles wanting, margin regularly rounded from the base to the anterior angles, which was subacute; disc not very convex, with an abbreviated, almost obsolete carina near the base. Elytra sericeous, with faintly impressed, slender striæ, which are impunctured; the outer and inner ones (as in most other species) coalescing at the tip. Tarsal joints short, stout; the first long-obconic, longer than either of the others; the second about two thirds the length of the first, obconic; third and fourth subtransverse, each produced beneath in the form of a cordiform lobe; the fourth emarginated above to receive the fifth joint, which is longer than the penultimate, attenuated at base, gibbous at the end, and terminated laterally by very small simple claws."

[Page 76] "This species differs from the *carinatum,* of Mr. Say, in having the thorax shorter and wider both at base and tip, the striæ of the elytra much less deeply impressed and impunctured, &c. &c. It approaches nearer to *tenuestriatum,* Say, which, however, is much smaller, and has punctured striæ.

"The tarsi of the *peltatum* are short and thick, like those of the *striatum,* Fabricius, and *carinatum,* Say; but the penultimate and antepenultimate

joints are obviously lobed beneath, as they are in XYLETINUS *sericeus*, Say. The antennæ of this last insect hardly warrant its being severed from the genus ANOBIUM; they resemble considerably those of our *peltatum*, but the last three joints are not so distinctly elongated." (This is 5292 [Henshaw], *Xyletinus peltatus* Harris.)

Page 76. "14. HISTER OBTUSATUS. Plate I, fig. 3.

"Black, immaculate; head with a transverse stria; thorax with two entire lateral striæ; each elytron obsoletely indented in the middle of the base, transversely punctured at tip, with an entire marginal, oblique abbreviated humeral, four entire and two abbreviated dorsal striæ; anterior tibiæ six-toothed on the outer edge.

"Length 36 hundredths, breadth 24 hundredths of an inch.

"*H. unicolor ? F. Say.* Journ. Acad. Nat. Sc. vol. v. p. 33.

"*Halsey's Collection*, No. 83.

"Body oblong oval, very obtuse before and behind, polished black, immaculate. External thoracic stria not abbreviated, but uniting behind with the inner one. Marginal and abbreviated oblique humeral striæ of the elytra very distinct; within the latter four dorsal striæ, the third of which has an obsolete indentation near its origin; the fourth beginning a little further from the base than the [page 77] third; the subsutural stria obsolete from the base nearly to the middle; the stria between it and the fourth dorsal has an arcuated rudiment near the base of the elytron, is discontinued from thence to behind the middle, and is abbreviated before the termination of the other dorsal striæ. A transverse series of obsolete punctures connects the posterior terminations of the second dorsal and subsutural striæ. Last abdominal segment very obtusely rounded, and, with the penultimate, exposed, and densely punctured. Anterior tibiæ six-toothed on the outer edge, the terminal tooth emarginated, and a minute tooth on the truncated tip just within the emarginated tooth.

"Is not this the species named *unicolor*, F. by Mr. Say, in his remarks on *H. depurator* in the Journal Acad. Nat. Sciences? The *unicolor* is described by Fabricius as having the anterior tibiæ tridentate, and the elytra obliquely tri-striated; characters which do not justify us in applying the same name to our insect, which agrees no better with the *unicolor* described by M. Boitard in the 'Manuel d'Entomologie.'" (This is 3480 [Henshaw], *H. interruptus* Beauv.)

Page 77. "15. TROX CAPILLARIS, *Say*. *T. capillaris, Say.* Journ. Acad. Nat. Sc. vol. iii. p. 238. *Halsey's Collection*, No. 97." (This is 5622 [Henshaw], *T. capillaris* Say.)

Page 78. "TANYMECUS LACÆNA, *Herbst*. *Curculio lacæna, Herbst.* Käfer, vol. vii. p. 350. Pl. 100. fig. 10. *T. lacæna ? Herbst. Say.* Curculionites, p. 9, No. 1. *Halsey's Collection*, No. —."

Page 80. "17. CENTRINUS ? DILECTUS. Plate I, fig. 4.

"Punctured, and with brassy scales; scutel whitish; third joint of the antennæ twice as long as the fourth.

"Length, exclusive of the rostrum, 20 hundredths of an inch.

"*Halsey's Collection*, No. 165.

"Body piceous black, densely punctured, and with elongated, brassy yellow scales. Head retracted to the eyes within the thorax, indented at the base of the rostrum. Rostrum as long as the head and thorax, slender, almost filiform, arcuated, slightly dilated over the origin of the antennæ, piceous, minutely and remotely punctured. Antennæ inserted behind the middle of the rostrum, piceous, club rufous; third joint (second of the funiculus,) two thirds the length of the preceding, and twice the length of the following joint. Thorax, in the middle, longitudinally elevated, or almost carinated, covered with linear-lanceolate scales, which converge from the sides towards the central carina. Elytra with acute, remotely punctured striæ, and flat interstitial lines, each one of which is covered with large, superficial, confluent punctures, and three series of linear-lanceolate scales; an oblique elevation or callus before the tip of each elytron. Body, beneath, more densely covered with whiter, shorter, oval scales. Breast, before the anterior legs widely indented, not canaliculate, unarmed."

[Page 81] "See the remarks under the following species." (This is 8920 [Henshaw], *C. dilectus* Harris.)

Page 81. "18. CENTRINUS SUTOR. Plate I, fig. 5.

"Black, punctured; scutel with white, and body with yellowish, linear scales; third and fourth joints of the antennæ together shorter than the second, subequal.

"Length, exclusive of the rostrum, 9 hundredths of an inch.

"*Halsey's Collection*, No. 167.

"Body black, densely punctured, and with linear-lanceolate yellowish or dirty white scales. Head indented at the base of the rostrum, retracted to the eyes within the thorax. Rostrum rather longer than the head and thorax, slender, arcuated, slightly dilated in the middle. Antennæ inserted just behind the middle of the rostrum; second joint (first of the funiculus,) longer than the third and fourth taken together; the fourth joint rather shorter than the third. Thorax obtusely carinated, covered with linear scales converging towards the central carina. Elytra with acute, remotely punctured stria, and flat, confluently but vaguely punctured interstitial lines, on each of which are three rows of linear scales. Scutel and posterior lobe of the thorax, in front of it, with white scales. Body, beneath, more densely covered with oval, whitish scales. Breast deeply and widely indented before the anterior legs, not canaliculate, but with a long, pendent spine in front of each of the anterior coxæ.

"This insect and the preceding one are evidently closely related. They agree in form of the head, rostrum, thorax, and body: the eyes, in both, are large, oval, not prominent, but rather flat, separated above only by the base of the slender rostrum, and below by a still narrower space. The thorax is conical, nearly as long as it is wide, tubulated before, without lobes behind the eyes, bisinuated behind, and produced in the middle of the base before the [Page 82] scutel. The elytra, taken together, are triangular, broadest at base, with prominent shoulders, attenuated behind, the tip not truncated nor obtusely rounded, but subacute, and each with a callus before the apex. The hinder legs are wider apart than the two other pairs; the tibiæ are truncated and with an exceedingly minute hook at the inside of the extremity; and the thighs are unarmed." (This is 8928 [Henshaw], *Geræus picumnis* Herbst.)

"The characters of the genus CENTRINUS, as laid down by M. Schoenherr, do not all apply to these insects, which have not 'the rostrum as long as the body,' nor 'the eyes distant,' nor 'the thorax almost double the width of its length'; and 'the club of the antennæ' is not very distinctly 'acuminated.' The antennæ of the *sutor* approach nearest to the description of those of CENTRINUS, but in the *dilectus*, the third joint is longer than it is represented to be in this genus. Notwithstanding these discrepancies there is no other in which they can be so properly arranged.

"From BARIDIUS, they differ in the form of the body, which is not rhomboidal, nor rounded behind, nor with the anal segment exposed; and the antennal joints are more elongated, and not so closely connected. They remind one (particularly the *dilectus*,) of the genus BALANINUS, in general form, color, and length of the rostrum; but cannot be referred to it on account of the structure of the breast, differences in the antennæ, and other essential characters."

Page 82. "19. TOMICUS ? PUSILLUS.

"Dark chestnut; head with erect hairs; thorax tuberculated before; posterior declivity of the elytra scabrous and hairy; antennæ and feet honey-yellow.

"Length 6 hundredths of an inch.

"*Halsey's Collection*, No. 260.

"Dark chestnut-brown. Head covered with long, erect [page 83] hairs. Thorax with short hairs, intermixed with elevated, thick points, which are larger in front and sloping backwards, smaller behind, and disappearing before the middle, behind which the thorax is minutely punctured and subglabrous. Elytra subglabrous, minutely punctured, rough on the posterior declivity, which is covered with short hairs or bristles arranged in longitudinal rows. Antennæ and feet brownish yellow, the club of the former paler.

"This minute insect probably belongs to the genus TOMICUS, but, being gummed on card, it could not be sufficiently examined. The body is cylindrical, obtuse and obliquely truncated behind. The club of the antennæ oval, compressed, three-jointed; the joints transverse, the last one semicircular and largest. The anterior tibiæ, the only ones which could be seen, were not very much dilated, and had a number of small teeth on the outer edge." (This is 9062 [Henshaw], *Pityophthorus minutissimus* Zimm.)

Page 83. "20. PRIONUS LÆVIGATUS. Plate 1, fig. 6.

"Chestnut-brown, subglabrous; thorax three-toothed; the last two joints of the maxillary palpi nearly equal; breast, in both sexes, hairy.

"Length from 1 inch and 12 hundredths to 1 inch and 52 hundredths of an inch.

"*P. lævigatus, Harris.* Catalogue, p. —.

"*Halsey's Collection*, No. 227. A male.

"*Cabinet of the Boston Soc. Nat. Hist.* No. 1362. male, No. 1360. female.

"Body chestnut-brown, smooth. Head confluently punctured, channelled longitudinally between the eyes; last joint of the maxillary palpi thicker but not much longer than the preceding one. Thorax short, transverse, minutely punctured; lateral margin horizontal, somewhat dilated, with a prominent reflected tooth on the anterior angle and middle; the hinder angles slightly

produced in [page 84] the form of a nearly rectangular, short tooth. Scutellum not obtusely and regularly rounded at tip, but subacute. Elytra elongated, somewhat oblong-quadrate, a little narrowed behind, slightly dilated at the middle of the sides, glabrous, not rugose, but with minute superficial punctures, and two longitudinal nearly obsolete elevated lines on each; sutural tip with a prominent spine. Body beneath glabrous, obsoletely punctured; breast with short, silky, yellowish hairs. Legs glabrous, and with small, distant punctures. Antennæ, in both sexes, with the same number of joints; in the male the third and following joints are dilated, produced beneath, and imbricated, but not emarginated at their tips; in the female they are long-obconic, compressed, slender. Last ventral segment of the male deeply indented.

"This large species differs from the *brevicornis*, F. in not having the elytra rugose nor confluently punctured; it is also of a more elongated shape, not so much narrowed behind, the thorax shorter, the anterior tooth of which is much more and the posterior one rather less prominent, and the terminal aculeus of each elytron longer. The *brevicornis* is of a much darker color, and is easily distinguished from it by its corrugated elytra. The *lævigatus* bears a closer resemblance to the *imbricornis*, L., but the antennæ of the male, like those of the female, have only twelve joints, and the joints are not so large, and so closely imbricated. The color is the same in both, and they are nearly equally smooth; but the elytra of the *imbricornis* are not very distinctly aculeated. Our species probably approaches to the *palparis*, Say, which is described as being black, with the last joint of the maxillary palpi very conspicuously longer than the preceding joint." (This is 5960 [Henshaw], *P. pocularis* Dalman.)

Page 84. "21. Clytus nobilis. Plate I, fig. 7.

"Black, thorax immaculate; each elytron with a large [page 85] yellow spot at base, a minute one on the outer margin behind the shoulder, a larger one before the middle, a transverse, slightly arcuated, slender band across the middle, and between this and the tip two spots transversely united.

"Length from 80 to 90 hundredths of an inch.

"*C. nobilis, Harris.* Catalogue, p. —.

"*Halsey's Collection*, No. 226.

"*Cabinet of the Boston Society, Nat. Hist.* No. —.

"This fine and strongly characterized species varies considerably in the size and distinctness of the elytral spots. Of five specimens, known to me, three have the arcuated band interrupted into three transverse spots, which, however, run together. In one there was the addition of a small, transverse, very faint spot just before the tip of each elytron; and, in another, the band and all the spots were obsolete, except the round one before the middle of the disc. Four of these specimens were taken upon Blue Hill in Massachusetts; Mr. Halsey's specimen was captured in Hartford, Connecticut.

"It is closely related to the Clytus *speciosus*, first described by Mr. Say in the Appendix to Keating's 'Narrative of Major Long's Expedition to the source of the St. Peter's River, &c.'; subsequently described and figured in his 'American Entomology'; and still more recently a figure of it has been published in

Griffith's Translation of Cuvier's Animal Kingdom, under the name of Clytus *Hayii*, G. R. Gray. The last name, of course, must sink into a synonyme. The *speciosus*, besides being larger, has the thorax fasciated, and the elytral bands and spots differently arranged, and is otherwise sufficiently distinct from our *C. nobilis*." (This is 6174 [Henshaw], *Calloides nobilis* Harris.)

Page 85. "22. Stenocorus ? linearis. Plate I, fig. 8.

"Testaceous; elytra paler, elongated-linear, separately [page 86] subacuminated; antennæ pilose; thorax unarmed, abruptly constricted behind.

"Length from 44 to 57 hundredths of an inch.

"*Halsey's Collection*, No. 140.

"Body testaceous, pilose. Head with a longitudinal impressed line. Antennæ a little longer than the body, joints elongated-cylindrical, terminal one obtusely rounded at tip, and nearly as long and large as the preceding one; all of them pilose. Thorax a little wider than the head, longer than broad, rounded at the sides, abruptly contracted behind, granulated, pilose, and with an impressed dorsal line. Elytra paler than the head and thorax, pilose, elongated linear, rugose, or confluently punctured as seen under a microscope, and with three slightly elevated lines; at tip each abruptly and triangularly narrowed on both sides, with the apex obtuse. Body beneath somewhat glabrous, sparingly pilose. Thighs simple; tibiæ and tarsi slender.

"Entirely distinct as to the form of the thorax and termination of the elytra from our other species of Stenocorus, to which genus I have doubtingly referred it. Compared with the Stenocorus *rigidus*, of Mr. Say, which has also the elytra entire or simply subacuminate at tip, it is a much more slender species, the antennæ not spined as in that insect, the thorax is differently shaped, and the color is not decidedly ferruginous, but of a dirty reddish yellow. I have seen only two specimens, one of which was captured in Louisiana." (This is 6017 [Henshaw], *Oeme rigida* Say.

Page 86. "23. Lamia (Acanthocinus?) obsoleta, *Olivier*."

(Page 87) "*L. obsoleta*, *Olivier*, Entomol. 4, No. 67, p. 130, pl. 13, fig. 90.

"*Halsey's Collection*, No. 121." (This is 6445 [Henshaw], *Acanthocinus obsoletus* Oliv.)

Page 88. "24. Lamia (Mesosa) fasciculatis. Plate I, fig. 9.

"Thorax white; elytra pale brown, variegated with dusky spots and elevated fasciculated points, whitish at base, and with an oblique whitish band behind the middle.

"Length 35 hundredths of an inch.

"*Halsey's Collection*, No. 231.

"Head with a longitudinal impressed line on the front, sulcated between the antennæ, which are rather longer than the body, and pale rufous, blackish at the tip of each joint. Thorax whitish, transverse, contracted abruptly behind, gradually before, punctured at the sides, and across the base and tip, rather unequal, with a small tubercle before the middle and one behind it, an impressed short line in the middle of the base; lateral spines replaced by a slightly elevated tubercle on each side. Elytra pale brown, punctured; humeral angles oblique; a faint whitish band across the base, and a more distinct, oblique one,

bordered behind with black, sloping forwards at the suture, just behind the middle; sides between the base and bands dusky; a small blackish spot near the suture behind the band, and another further back and contiguous to the outer margin; a subsutural series of small, fasiculated, black points, another on the middle of each elytron, and several rather larger scattered over the surface, particularly towards the base, near the middle of which are two much more prominent than the rest; tips of the elytra obliquely truncated. Body, beneath, dusky or chocolate brown, densely covered at the sides of the breast, and sparsely on the abdomen with short, ashen-colored hairs. Thighs blackish brown at base, ashen at tip; tibiæ ashen, with a narrow blackish band on the middle and a broad one at tip; tarsi blackish.

"This species closely resembles *L. macula*, Say, which is much more convex, or not so much depressed, proportionally shorter and thicker, with a rather narrower, more [page 89] cylindrical thorax, with the punctures of the elytra more dilated, without the elevated fasciculated points at the base, besides other characters which sufficiently distinguish it from the *fascicularis*. Lamia *alpha*, Say, is a smaller, more slender, more parallel species, with the dorsal fascia much more oblique, &c." (This is 6428 [Henshaw], *Liopus fascicularis* Harris.)

Page 89. "25. Molorchus mellitus, *Say*.

"*M. mellitus, Say*, Boston Journ. Nat. Hist. vol. i. p. 194.

"*Halsey's Collection*, No. 263. A female." This is a variety of *mellitus* which is described. (This is 6225 [Henshaw], *Necydalis mellitus* Say.)

Page 89. "26. Cryptocephalus canellus ? *Fabricius*. Plate I, fig. 10."

[Page 90] "*C. canellus ? F.* Eleuth. vol. ii. p. 52. *C. cinctus ? F.* Entom. Syst. vol. i. part 2. p. 63. *Halsey's Collection*, No. 176.

"This insect agrees better with the description of the *cinctus* than with that of the *canellus*. M. Fabricius says that the former inhabits South America and the latter Carolina. It may be a variety of the *canellus* in which the two black spots run together and unite with the black suture. Under this impression, and because it is a North American species, I have described it under the name of *canellus*, with a doubt however as to its identity. It has the form of Colaspis *quercus*, S." (This is *Typophorus canellus* Fabr.)

Page 90. "27. Galeruca (Adimonia) cristata. Plate I, fig. 11.

"Black; thorax rufous with a black disc and two impressed spots; elytra with the margin dilated, a lateral elevated and an abbreviated impressed line.

"Length from 17 to 19 hundredths of an inch.

"*G. A. unicolor, Harris*, Catalogue, p. —.

"*Halsey's Collection*, No. 218.

"Black, above and beneath. Front, between the antennæ carinated, vertex indented. Antennæ about two-thirds the length of the body; first joint obconic, second globose, third very short obconic, the two together shorter than the fourth, which, with the following ones, is elong- [page 91] ated obconic; terminal joint oblong-ovate, acuminated. Thorax impunctured, quadrate, glabrous, rather broader than long, slightly contracted behind, the lateral edges acute; convex, black from the anterior to the posterior margin, sides more or less obscurely rufous; a deep indentation each side of the centre.

Elytra purplish black, confluently but not deeply punctured, oblong quadrate, rounded behind, with the lateral margin horizontally dilated, and elevated on the edge, a submarginal elevated line beginning at the humerus, and on a short, longitudinal furrow within the elevated line; base with an obsolete tubercular elevation in the middle; suture slightly elevated. Breast, abdomen beneath, and feet deep black.

"This species probably bears a close resemblance to the *atripennis*, S., which has the thorax and body beneath rufous.

"The specific name *unicolor* was applied to specimens in which the rufous color of the sides of the thorax was indistinct or obsolete. It is, however, inappropriate, and is therefore changed." (This is 6891 [Henshaw], *Diabrotica atripennis* Say.)

# DIPTERA FROM THE SOUTH-WESTERN UNITED STATES

## Paper IV. Anthomyiidae[1]

BY J. R. MALLOCH

*Urbana, Illinois*

For several years I have been making an exhaustive study of Anthomyiidae from North and South America and Europe, with a view to obtaining data upon which to base a reliable family, subfamily, and generic classification of the calypterate Muscidae, and it was with this end in view that I undertook the work upon the present collection. The work was undertaken with the permission of Dr. S. A. Forbes, chief of the Illinois State Natural History Survey, and the material was studied in conjunction with that in the Survey collection, a few species from the latter collection being added where it was considered advisable to do so, in order to make the paper more complete and to supply comparative data or records.

[This is the fourth of the series of papers based on the material collected in Texas and New Mexico, in 1902, by H. L. Viereck and J. A. G. Rehn, on an expedition under the direction of The Academy of Natural Sciences of Philadelphia.

Included in this paper is material from California and Idaho, collected by E. T. Cresson, Jr., and from several other, mostly western, localities secured by various collectors. In the latter cases the collector's name, when known, is given within parentheses. In every case unless otherwise designated within brackets, the material studied is from, and the types of species from such material are in, the collection at The Academy of Natural Sciences of Philadelphia.

A key to the subfamilies of the Anthomyiidae will be found in the *Canadian Entomologist*, for 1917, page 406. *E. T. C., Jr.*]

[1] The previous papers may be found by the following references: No. 1, Trans. Amer. Ent. Soc., xxxii, p. 279; No. 2, Trans. Amer. Ent. Soc., xxxiii, p. 99; No. 3, Ent. News, xxvi, p. 448.

## Subfamily Phaoniinae

The species included in the subfamily as herein limited possess the following characters: Sixth vein not extending to margin of wing; hind tarsus without spine at base on ventral surface, except in a few species of *Pogonomyia* scutellum bare below; sternopleura with bristles 2:2, or 1:2, if the latter they are not in an equilateral triangle; propleura bare below humerus; calyptra unequal, the lower always larger than the upper.

### *Key to Genera Here Treated and Their Nearest Allies*

1. Fourth vein curved forward at apex ..... 2
   Fourth vein straight or almost so, never distinctly curved forward at apex ..... 5
2. Third vein bare at base; metathoric spiracle with several long bristles along the lower margin which are difficult to see owing to their lying close against the covering of the spiracle ..... **Muscina** R.–D.
   Third vein bristled at base; metathoracic spiracle without such bristles .. 3
3. Prothoracic plate between the fore coxae with bristly hairs on its lateral margins; arista pubescent or bare ..... **Limnophora** R.–D., pt.
   Prothoracic plate between the fore coxae bare ..... 4
4. Arista plumose; eyes in male narrowly separated above .. **Myiospila** R.–D.
   Arista bare; eyes of male widely separated above .. **Bucephalomyia** gen. n.
5. Eyes of male separated by at least one-third the width of the head; arista in both sexes bare, much thickened to or nearly to middle; apical segment of abdomen in female with four stout curved thorns; anterior orbital bristles below level of base of antennae .... **Tetramerinx** Berg
   Eyes of male separated by less than one-third the width of head, or the species have not all the above characters ..... 6
6. Hind tibia with one long, outstanding bristle beyond middle on the postero-dorsal surface, rarely with a few additional smaller setulae basad of the bristle; hind coxae bare on posterior margin above. **Phaonia** R.–D.
   Hind tibia entirely without bristles on postero-dorsal surface ..... 7
   Hind tibia with a number of bristles on postero-dorsal surface which are of almost equal lengths, or with one to two small setulae near base, if with one long bristle beyond middle the hind coxae have bristly hairs on posterior margin above ..... 11
7. Third vein bristly at base ..... **Mydaea** R.–D.
   Third vein bare at base ..... 3
8. Hind coxae with bristly hairs at apices above ..... **Trichopticus** Rond., pt.
   Hind coxae bare above at apices ..... 9
9. Eyes of male flattened above, the facets on the flattened part about five times as large as those on the lower half; fifth abdominal sternite with very large, deep U-shaped incision in posterior margin; genitalia of female without paired projecting processes (figs. 1 and 2). **Xenaricia** gen. n.

Eyes of male not flattened above, the facets usually slightly enlarged towards the upper margin; female genitalia not as above.....10

10. Prealar bristle present, sometimes small, if absent the arista is plumose.
**Aricia**[2] R.–D., pt.

Prealar bristle absent; arista pubescent or bare. .**Limnophora**[2] R.–D,. pt.

11. Hind coxae with a number of hairs on posterior margin above.
**Trichopticus** Rondani, pt.

Hind coxae bare on posterior margin above.....12

12. Hind tibiae with several very long strong bristles on postero-dorsal surface; lower calypter not much larger than upper; lower supraorbital bristle in female directed forward or outward and usually very long; fore tarsi of both sexes without long, slender, isolated sensory hairs, the joints all with erect fine hairs ventrally, in the female with a number of longer hairs at apex on same surface; fore tibia with one to two long bristles at apex on ventral surface, which are directed apicad close to ventral surface of basal joint of tarsus.....13

Hind tibia with at most a few weak bristles on postero-dorsal surface; lower calypter very much longer than upper; lower supra-orbital bristle in female weak, or absent, not directed forward; fore tarsi in both sexes with long, fine, isolated sensory hairs....**Aricia** R.–D., pt.

13. Apex of proboscis stout, without recurved pointed labellae.
**Pogonomyia** Pokorny

Apex of proboscis with a pair of pointed recurved labellae. .**Drymeia** R.–D.

### MYIOSPILA R.–D.

This genus has been considered as synonymous with *Mydaea* by Stein who retains in the latter all species that lack the calcar on the hind tibia. There are several genera lumped together by various authors who have used that character in separating the genera, and though *Myiospila* is more closely related to *Mydaea* sens. str., than are some of the other groups referred to, I consider it is inadvisable to sink it as synonymous with that genus until we know something of the immature stages of the latter.

**Myiospila meditabunda** Fabricius

1781. *Musca meditabunda* Fabricius, Spec.Ins., ii, 444.

One small male, Lagunitas Cañon, Marin County, California, March 29, 1908.

[2] The above genera are very closely related and each contains a mixture of forms which requires further subdivision; in fact the genera as at present constituted are not natural groups.

**PHAONIA** R.-D.

This genus as herein limited includes species which have a strong bristle on postero-dorsal surface of hind tibia beyond middle, the third vein bare at base, and not curved forward at apex, the hind coxae bare at apex above; in the female the lower supra-orbital bristle is weak, not directed forward, and the cruciate interfrontals are absent.

The genus is composite and must be redefined and the limits further restricted.

**Phaonia monticola** sp. n.

*Male* and *Female*.—Black, shining. Interfrontalia of female and cheeks of both sexes brown. Thorax, when seen from behind, with three gray pruinescent vittae on dorsum. Abdomen with a distinct black dorsal stripe and very poorly defined lateral checkering. Legs black. Wings slightly fuscous towards base and along veins. Squamae white. Spiracles black. Halteres with knobs yellow.

*Male*.—Eyes hairy, separated by less than width across posterior ocelli; parafacials in profile nearly twice as wide as third antennal joint, and about half as wide as height of cheek; mouth very much produced; vibrissae distinctly above mouth margin; arista plumose; palpi very long and slender. Thorax with four pairs of posterior dorso-centrals; presutural acrostichals not setose; sternopleura with three bristles; hypopleura hairy above, in front of spiracle. Abdomen elongate ovate; fifth sternite deeply excised in center. Fore tibia not longer than fore tarsi, usually with one to two weak, hair-like, posterior bristles on middle, the inner or ventral surface with dense erect hairs, which become longer on apical half, the longest at least equal in length to diameter of tibia; mid femur with rather dense bristly hairs on basal half of antero-ventral surface, the longest about equal in length to portion of femur upon which they are situated; the postero-ventral surface with three to five long, strong bristles on basal half; mid tibia with two to three antero-dorsal, two to four postero-dorsal, and two to three posterior bristles, the latter two rows forming an irregular series which might be considered as an irregular double posterior series; hind femur with a continuous series of long, strong bristles on antero-ventral surface, and four to six strong, but short, bristles, on basal half of postero-ventral surface, none of which exceed in length the diameter of femur; hind tibia slightly curved; antero-ventral surface with two to four weak bristles; antero-dorsal surface usually with four bristles, one pair near base and another about middle; anterior and antero-dorsal surfaces each with a regular series of erect hairs, the longest of which is about half as long as the bristles; in addition to the calear there is a slender bristle near base on postero-dorsal surface. Costal thorn weak; outer cross-vein oblique, slightly curved.

*Female.*—Front one-third the head-width; orbital and ocellar bristles very strong; orbits with numerous long hairs, some of which are over half as long as the bristles; profile similar to that of male, differing in having the portion below vibrissa almost vertical and about as long as antenna. Apical abdominal segment without thorns. Chaetotaxy of legs as in male, the small bristly hairs on hind tibia less numerous. Length, 7.5—8.5 mm.

*Type.*—♂; Top of Las Vegas Range, New Mexico, June 24, [A. N. S. No. 6192]. *Paratypes.*—2♂, 1♀; Beulah, New Mexico, top of range, same date.

This species is most closely related to *brunneinervis* Stein, but that species differs in having the fore tibia without the short erect ventral hairs, the mid femur with long bristles among the hairs on basal half of antero-ventral surface, the bristles on postero-ventral surface of hind femur longer than diameter of femur, and the hind tibia with a few scattered bristly hairs near middle, instead of one bristle near base.

**Phaonia parviceps** sp. n.

*Female.*—Black, almost glossy. Head black; interfrontalia brownish, opaque; ocellar triangle and orbits glossy, the latter on their lower half, the entire face, and cheeks with whitish pruinescence; antennae and palpi black. Mesonotum with slight whitish pruinescence, which, when the thorax is viewed from behind, gives to the dorsum a quadrivittate appearance. Abdomen less distinctly pruinescent than thorax, and with very faint indications of a black dorso-central vitta. Legs including coxae yellow, tarsi slightly infuscated. Wings clear, veins brown, yellow at bases. Calyptra and halteres whitish yellow.

Eyes with faint pubescence; frons at vertex about one-fourth the head-width, becoming broader in front; ocellar triangle extending slightly beyond middle of interfrontalia; orbit at apex of triangle one-third as wide as interfrontalia; ocellar bristles very strong, widely divergent; orbits each with five strong bristles, the one nearest antennae longest, and numerous short setulose hairs; antennae reaching almost to vibrissae, third joint over three times as long as second, slightly angulate at apex on upper side; arista plumose, the longest hairs slightly longer than width of third antennal joint; facial orbits linear in profile; cheeks very narrow, not higher than width of third antennal joint, the lower margin with a series of long bristles above which are a few weak hairs; vibrissal angle very slight, not much above lowest level of cheek, the vibrissae very strong, slightly longer than face. Thorax with three pairs of postsutural dorso-central bristles; presutural acrostichals four-rowed, the outer series on each side strongest; prealar bristle minute; hypopleura bare. Third and fourth (visible) abdominal segments each with discal bristles, the series on posterior margin of third segment very strong, that on fourth much weaker; apical segment without thorns. Fore tibia with one posterior and

two antero-dorsal bristles; mid femur with two to three weak bristles at base on antero-ventral surface and five to six longer bristles on postero-ventral; mid tibia with three bristles on posterior surface; hind femur with two to three weak bristles on basal half of postero-ventral surface, and a series of bristles on antero-ventral, the apical three to five much stronger than the others; hind tibia with two antero-ventral and two antero-dorsal bristles; the preapical postero-dorsal bristle (calcar) not noticeably longer than upper antero-dorsal. Wing-veins except costa bare; costal thorn of moderate length; outer cross-vein slightly curved; apical sections of veins three and four slightly divergent. Length, 6.5 mm.

*Type.*—♀, Yosemite Valley, California, May 22, 1908, [A. N. S. No. 6193].

This species belongs to the same group as *P. palpata* Stein, a European species, but differs in color of legs, etc. I have seen no very closely allied North American form.

**Phaonia nigricauda** sp. n.

*Male* and *Female.*—Fulvous, glossy. Head blackish brown, back of head grayish pruinose, frontal orbits and face with whitish iridescent pruinescence; antennae and palpi brown, second joint of former and base of latter paler. Thorax unmarked. Abdomen with apical half conspicuously blackened. Legs fulvous, tarsi slightly infuscated. Wings clear, veins pale brown. Calyptra and halteres yellow.

*Male.*—Eyes with very short pubescence, separated at narrowest part of frons by a distance nearly or quite equal to width across posterior ocelli; antennae reaching to upper mouth margin, third joint over twice as long as second; arista long and slender, plumose, the longest hairs about equal in length to width of third antennal joint; parafacials almost linear in profile; cheek about as high as width of third antennal joint. Presutural acrostichals four-rowed, the outer series on each side strongest; postsutural dorsocentrals three; hypopleura bare; posterior spiracle small, subtriangular. Abdomen elongate, slightly tapered at apex, the last two segments with postmarginal and discal bristles; fifth sternite with a deep, broad, central excision. Fore tibia sometimes unarmed, at times with an anterodorsal bristle near middle; mid femur with four to five long slender bristles on basal half of postero-ventral surface; mid tibia with two to four posterior bristles; hind femur with a series of widely spaced bristles on antero-ventral surface, and another, weaker, on basal half of postero-ventral surface; hind tibia with one to two weak antero-ventral and two stronger antero-dorsal bristles; calcar short and stout. Wing-veins bare; outer cross-vein bent; apical sections of veins three and four sub-parallel.

*Female.*—Differs from the male in having the frons one-third as wide as head, the fore tibia sometimes with an antero-dorsal and a posterior bristle, and the mid and hind femoral bristles weaker and less numerous. Length, 6 to 7 mm.

*Type.*—♂; Redwood Cañon, Marin County, California, May 17, 1908, [A. N. S. No. 6194]. *Paratypes.*—2♂, 3♀; topotypical; 1♀, Berkeley Hills, April 20, 1908; 2♂, 1♀, same locality, May 9, 1908; 1♂, Muir Woods, Marin County, May, 1908 (F. E. Blaisdell), all in California.

This species bears a striking resemblance to *Spilogaster fulva* Bigot, a species recorded under another generic name on a subsequent page of this paper and which occurred along with the type series.

I know of no closely allied North American species, the glossy fulvous thorax and abdomen readily separating it from any species known to me.

**Phaonia fuscicauda** sp. n.

*Male.*—Yellowish testaceous, slightly shining. Head yellow, occiput with more than the upper half gray, pruinescent; third antennal joint brown except at base. Dorsum of thorax slightly gray pruinescent and with four indistinct brown vittae, the submedian pair with dark suffusion between them so that they appear almost like a broad median vitta. Abdomen with a mediodorsal row of fuscous spots, the one on third segment most distinct, apex of third segment and whole of fourth fuscous, the large bristles on the last two segments with the base of each surrounded by a fuscous dot. Legs yellowish testaceous, tarsi slightly darkened. Wings clear, cross-veins conspicuously, but not very broadly, infuscated. Calyptra whitish. Halteres yellow.

Eyes conspicuously hairy, separated at narrowest part of frons by a distance equal to width of anterior ocellus; antennae reaching almost to mouth margin, third joint narrow, slightly dilated at apex, over two and one-half times as long as second; arista plumose, the longest hairs equal in length to width of third antennal joint; parafacials in profile narrower than third antennal joint; cheek slightly less than one-fourth as high as eye, marginal bristles irregular, moderately strong, none upwardly curved, a double series of hairs above bristles; proboscis very stout. Thorax with two to three pairs of widely placed presutural acrostichals and about eight series of hairs on same area; postsutural dorso-centrals four; sterno-pleurals three; hypopleura bare; posterior spiracle large, subtriangular. Abdomen broadly ovate; fifth sternite with a broad wedge-shaped excision. Fore tibia unarmed at middle; mid femur with nine to ten long hair-like bristles from base to beyond middle on postero-dorsal surface; mid tibia with two to three posterior bristles; hind femur with a complete series of rather short bristles on antero-ventral surface and another on basal half of postero-ventral; hind tibia with one to three antero-ventral, and two antero-dorsal bristles, calcar not very long; outer cross-vein at about its own length from inner; last section of veins 3 and 4 slightly divergent at apices, that of the latter about three times as long as preceding section. Length, 6 mm.

*Type.*—♂; Berkeley Hills, California, April 20, 1908, [A. N. S. No. 6195].

This species bears a striking resemblance to the pale variety of *Aricia lysinoë* Walker which occurs in the west.

**ARICIA** R.-D.

The characters that are used in the separation of this genus from others in the key on a previous page undoubtedly link together groups of species that are dissimilar in habitus and which are biologically distinct, but the further elucidation of the relationships cannot for various reasons be undertaken in the present paper.

**Aricia latifrontata** sp. n.

*Male* and *female.*—Black, shining. Head black, interfrontalia, face, and cheeks brownish, opaque, slightly whitish pruinescent; ocellar triangle shining; orbits subopaque. Thorax with four black dorsal vittae, the spaces between these grayish pruinose. Abdomen with sparse whitish pruinescence on dorsum, which is most distinct when viewed from behind, forming a central stripe and irregular patches on anterior angles and sides so that each segment appears to have two large subcontiguous irregular black spots. Legs black. Wings slightly grayish. Calyptra white. Knobs of halteres yellow.

*Male.*—Eyes bare; frons at vertex one-fourth as wide as head, slightly narrowed at apex of ocellar triangle and widened anteriorly; orbits narrow, each with six to eight strong bristles and a number of long bristly hairs; antennae shorter than face, third joint twice as long as second; arista plumose, the longest hairs at least as long as width of third antennal joint; parafacials in profile a little narrower than third antennal joint, and less than half as wide as height of cheek, the latter with numerous strong marginal bristles of irregular lengths and above them a number of short hairs; vibrissal angle not sharply produced, vibrissa very long and strong, with a few bristly hairs above it; proboscis short and stout; palpi long, slender. Presutural acrostichals represented by six to eight series of short setulose hairs; postsutural dorso-centrals four in number. Abdomen elongate, slightly tapered apically; dorsum with strong bristles both on discs and apices of segments; hypopygium small, retracted; fifth sternite with rounded post-marginal excision. Legs stout, strongly bristled; fore tibia with one posterior bristle at middle; mid tibia with two to three anterior, and three to five posterior bristles; hind femur with three to four bristles at apex on postero-ventral surface, the antero-ventral surface with a series of strong bristles from base to apex; hind tibia with four to six antero-ventral, two antero-dorsal, and three to five posterior bristles, the latter weaker than the others and rarely passing beyond middle of tibia, none of them representing the so-called "calcar." Costa with short spinules; costal thorn longer than inner cross-vein; outer cross-vein curved, at more than its own length from apex of fifth vein; veins 3 and 4 very decidedly divergent at apices.

*Female.*—Differs from the male in having the frons over one-third the head-width, the bristles of tibiae less numerous, those on posterior surface of hind pair usually one to three in number and confined to basal fourth, and the abdomen more conical, without any traces of dorsal spots. Length, 8 to 9 mm.

*Type.*—♂; Beulah, New Mexico, June 28, 1902, top of range, [A. N. S. No. 6196]. *Paratypes.*—1♂, 2♀; topotypical; 1♂, Bozeman, Montana, June 20, 1906. [Montana Exp. Sta.]; 1 ♀, same locality, June 12, 1903, elevation of 4700 feet. [Montana Exp. Sta.].

The above species differs from any North American form known to me in having a very broad frons in the male and in the deep black color.

**Aricia punctata** Stein

1897. *Aricia punctata* Stein, Berl. Ent. Zeit., xlii, 182.

The collection contains one female from Clouderoft, New Mexico, June 16.

**Aricia lucorum** Fallen

1823. *Musca lucorum* Fallen, Dipt. Succ., Muse., 55.

One male, Yosemite Valley, California, May 22, 1908; one male and two females, Redwood Cañon, Marin County, California, May 17, 1908; one male, Moscow, Idaho, June 2, 1908.

A widely distributed species both in North America and Europe.

**Aricia brevis** Stein

1897. *Aricia brevis* Stein, Berl. Ent. Zeit., xlii, 180.

There is one female specimen in the collection which agrees with the type specimen in the Hough collection, except that it is smaller.

Locality; Beulah, New Mexico, June 28, 1902, top of range.

**Aricia poeciloptera** sp. n.

*Female.*—Black, densely gray pruinescent. Head black, densely gray pruinescent; when viewed from in front there is a silvery quadrate spot visible on parafacials at base of antennae, which when viewed from the side becomes black; antennae black; palpi fuscous. Thorax with four rudimentary brown vittae on dorsum. Abdomen with two pairs of brown spots on dorsum; the larger bristles set in small brown dots. Legs black, apices of femora and all of tibiae reddish yellow. Wings clear, both cross-veins broadly infuscated. Calyptra white. Halteres yellow.

Frons slightly more than one-third the width of head at vertex, broader anteriorly; longest hairs on arista equal to basal diameter of arista; cheeks one-fourth as high as eye. Presutural acrostichals weak, irregularly four rowed; postsutural forso-centrals three; sternopleurals 2:2. Fore tibia unarmed at middle; mid tibia with two to three posterior bristles; hind femur with three to five strong bristles on apical half of antero-ventral surface; hind tibia with two to three weak antero-ventral bristles, and one strong one at middle on antero-dorsal surface. Costal thorn longer than inner cross-vein. Length, 5.25 to 6 mm.

*Type.*—♀; Cloudcroft, New Mexico, May 21, 1902, [A. N. S. No. 6197]. *Paratype.*—1 ♀, topotypical, May 23, 1902.

Closely allied to *obscurinervis* Stein, but that species has one to two bristles on the fore tibia, the hind femora with a strong bristle near middle of the postero-ventral surface, and the longest hairs of the arista equal in length to width of third antennal joint.

**Aricia lysinoë** Walker

1849. *Anthomyia lysinoë* Walker, List. iv, 938.

I have a large number of specimens of this species from many localities in the United States, and after careful study of Stein's types I have concluded that *lysinoë* Walker, *amoeba* Stein, and *pubiceps* Stein are all one species. It is possible that *fulviventris* Bigot is also a synonym.

The species varies in color from black, with apex of scutellum fulvous (*pubiceps*) to entirely fulvous (*fulviventris?*). The abdomen is pale at base in *amoeba*, type-specimen, but along with the type are some Idaho specimens which have the thorax and abdomen fulvous with one to two pairs of fuscous spots on dorsum of abdomen. This pale form I have seen only from the west, Idaho and Oregon, and there is one specimen of it in the present collection taken in the Yosemite Valley, California, May 22, 1908.

**XENARICIA** gen. n.

*Generic characters.*—Eyes bare, almost contiguous above in male, with a flattened area above on which the facets are very much enlarged, about five times as large as those on the lower half of eye; eyes of female widely separated, the frontal chaetotaxy as in *Phaonia;* arista plumose; proboscis short and stout. Prealar bristle absent; hypopleura bare. Fifth abdominal sternite of male with a very large, deep U-shaped posterior excision;

genitalia of female without the pair of long apically rounded processes so noticeable in *Phaonia* (figs. 1 and 2). Hind tibia without bristles on the postero-dorsal surface.

Genotype, *Spilogaster fulvus* Bigot.

**Xenaricia fulva** Bigot

1885. *Spilogaster fulvus* Bigot, Ann. Soc. Ent. France, (6), iv, 289.

Two males and two females with data as follows: Redwood Cañon, Marin County, California, May 17, 1908.

**BUCEPHALOMYIA** gen. n.

This genus is erected for the reception of one species, which was originally described as *Tetramerinx femorata* by the present writer. From that genus it may be separated by the lack of thorns at the apex of the abdomen in the female, the distinctly convergent third and fourth veins in both sexes, the third also having several bristles at base both above and below.

I have not seen the male of *Tetramerinx unica* Stein, the genotype, but the female possesses characters that undoubtedly place it in the Phaoniinae and not in Coenosiinae.

**Bucephalomyia femorata** Malloch

1913. *Tetramerinx femorata* Malloch, Proc. U. S. Nat. Mus., xiv, 603.

The female of this species has previously been unknown. It differs from the male in having no comb of short stiff bristles at base of ventral surface of hind femora.

Neither sex has any bristles on the ventral prothoracic plate between the fore coxae, a character that separates the genus from that section of *Limnophora* which has the third and fourth veins convergent apically and the former with bristles at base.

Locality: Alamogordo, New Mexico, one male, May 3; one female, May 5; one male, May 6, 1902.

**TETRAMERINX** Berg

This genus is represented in this collection by one species. I have only females of the genotype before me, but the specimen in this collection is undoubtedly different from these and is without question congeneric with them.

*Generic characters.*—Frons slightly over one-third the head-width, anterior orbital bristle slightly below base of antennae, the

latter elongate, third joint more than twice as long as second; arista bare, much thickened on basal half; presutural acrostichals two-rowed; postsutural dorso-centrals four; sternopleurals 1: 2; apical abdominal segment in female with four short, stout, curved thorns; third vein bare at base.

**Tetramerinx californiensis** sp. n.

*Female.*—Black, slightly shining, densely gray pruinescent. Head black, opaque, frons, face, orbits, and cheeks with dense, slightly brassy pruinescence; antennae, proboscis and palpi black. Thorax with three narrow brown vittae, one along bases of acrostichals, the others along bases of dorso-centrals, the larger bristles on dorsum each set in a brown dot. Abdomen with an interrupted dorso-central brown line, a similarly colored spot on each side of dorsum of segments two and three, and a brown dot surrounding base of each bristle. Legs black, all of tibiae and apices of femora ferruginous. Wings clear, veins brown. Calyptra white. Halteres yellowish.

Each orbit with four strong bristles and a number of setulose hairs, the latter most numerous anteriorly laterad of the bristles; cheek about twice as high as width of parafacial in profile. Mid tibia with two posterior bristles; hind femur with two strong bristles on antero-ventral surface near apex; hind tibia with one antero-ventral, one postero-dorsal, and two antero-dorsal bristles. Venation similar to that of *unica* Stein. Length, 4.5 mm.

*Type.*—♀; San Francisco, California, May 27, 1908, (F. E. Blaisdell), [A. N. S. No. 6198].

The only other described species which belongs to the genus is *unica* Stein, which has the abdomen with central stripe only, and the legs black. The species I described as *Tetramerinx brevicornis* does not belong to this genus but to one of the segregates of *Limnophora*.

## LIMNOPHORA R.-D.

There are several species of this genus in the collection, all the specimens being females.

**Limnophora narona** Walker

1849. *Anthomyia narona* Walker, List, iv, 945.

This species is distinguished from all others known to me from North America, except *discreta* Stein, by the convergence of the third and fourth veins at their apices, and the presence of bristles on base of third vein and on the plate on venter of prothorax between the fore coxae. These characters in my opinion justify the generic separation of the species possessing them from the

others in *Limn phora*, but the exact status of the latter is uncertain, the genotype being an unrecognized European species. Several generic names have been used by authors for sections of *Limnophora*, but careful work will be necessary to establish the validity of any of these. The absence or presence of the prealar bristle is quite unreliable as a distinguishing character for this and allied genera.

Localities: twelve specimens, Berkeley Hills, Alameda County, California, April 11 and 20, 1908; six specimens, Yosemite Valley, California, May 22, 1908; one specimen, Highrolls, New Mexico, May 31, 1902.

**Limnophora discreta** Stein

1897. *Limnophora discreta* Stein. Berl. Ent. Zeit., xlii, 204.

This species can be distinguished from the preceding one by the much less distinct forward curvature of the fourth vein.

One female in poor condition, Redwood Cañon, California, May 17, 1908.

**Limnophora aequifrons** Stein

1897. *Limnophora aequifrons* Stein, Berl. Ent. Zeit., xlii, 205.

The female of this species is distinguished from any so far described from North America by the very narrow frons, which at vertex is much less than one-third the head-width.

Four females: Berkeley Hills, Alameda County, California, April 20, 1908; Redwood Cañon, Marin County, California, May 17, 1908; Alamogordo, New Mexico, May 8, 1902; and Troy, Idaho, May 31, 1908.

**Limnophora surda** Zetterstedt

1845. *Aricia surda* Zetterstedt, Dipt. Scand., iv, 1476.

Four females are in collection with data as follows: two specimens, Redwood Cañon, Marin County, California, May 17, 1908; one specimen, Beulah, New Mexico, top of Las Vegas range, June 28, 1902; one specimen, Moscow, Idaho, June 2, 1908.

**TRICHOPTICUS** Rondani

There is only one specimen of this genus in the collection, a female, which differs so strikingly from any other known to me from this country that I have no hesitation in describing it as new.

**Trichopticus maculiventris** sp. n.

*Female*—Black, slightly shining, with dense yellowish brown pruinescence. Head entirely black, the interfrontalia velvety black when seen from behind. Thorax with a blackish vitta on each side between acrostichals and dorso-centrals on anterior half of dorsum. Abdomen with a pair of rounded, widely separated black spots on dorsum of segments two and three, and a much less distinct dorso-central stripe or series of spots on all segments. Legs black. Wings clear. Calyptra and halteres orange yellow.

Eyes bare, separated by over one-third the width of head; ocellar triangle not carried to middle of frons; orbits one fourth as wide as interfrontalia, each with four bristles, the lower one strongest, the one above it directed forward, no hairs on orbits; cruciate bristles moderately strong; antennae stout, shorter than face, third joint nearly three times as long as second; arista with distinct pubescence; parafacials not visible in profile; cheek about one-eighth as high as eye. Presutural acrostichals strong, three pairs, with interspersed hairs; post-sutural dorso-centrals three, the anterior one weak, probably sometimes duplicated; sternopleurals 1: 1. Fore tibia unarmed at middle; mid femur with one strong bristle at middle on anterior side; mid tibia with one posterior bristle; hind femur with three to four short bristles on apical third of antero-ventral surface; hind tibia with two to three weak, short bristles on antero-ventral surface; preapical dorsal bristle rather far from apex. Third and fourth veins slightly convergent at apices; outer cross-vein slightly curved; lower calypter very little larger than the upper. Length, 3.75 mm.

*Type.*— ♀ ; Troy, Idaho, May 31, 1908, [A. N. S. No. 6199].

This species differs from all others known to me in having no strong bristles on postero-dorsal surface of hind tibia, and in having the dorsum of the abdomen with paired spots. It bears a strong resemblance to species of the genus *Hydrotaea* in thoracic chaetotaxy, but no species of the Hydrotaeinae has the bristles on apex of hind coxae above, as in this species.

**POGONOMYIA** Pokorny

Recently a revision of this genus by Dr. J. M. Aldrich appeared in Entomological News.[3] The definition of the genus given in

[3] 1918, p. 179.

that paper is, though vague, as good as any previously published, but does not mention the characters cited in the key to genera given on a preceding page of the present paper. A summary of the generic characters is as follows: Eyes bare, narrowly separated in the male, widely separated in the female, orbits bristled on their entire length in both sexes, *lower supraorbital in female directed forward;* parafacials broad in profile, sometimes as broad as

height of cheek, the latter with a broad, anteriorly rounded area which is covered with closely placed upwardly directed bristly hairs. Prealar bristle strong; *lower calypter not twice as large as upper*. Abdomen subcylindrical; fifth sternite almost transverse at apex; in female the abdomen is pointed at apex and the last segment has two moderately long, apically rounded processes which are armed with weak hairs. *Fore tarsi in both sexes without long, fine, isolated sensory hairs, in female with very noticeable erect, stiff hairs ventrally*, those at apices of joints longer than the others; hind tibia with several long strong bristles on postero-dorsal surface; *hind coxae bare at apex above*.

The subgenus *Pogonomyia* Pokorny is separable from *Neopogonomyia* S. and D., as shown in the key to the males presented herewith.

The most closely allied genus is *Drymeia* R,-D., which has the apical labellae of the proboscis elongated, sharp at apex, and recurved. This genus has been reported from North America but I have seen only European specimens.

## *Key to Species*

### Males

1. Mid tibia with one or more bristles on antero-ventral and always several on the anterior surface; basal joint of hind tarsi with an outstanding ventral bristle near base; arista with very short pubescence (*Pogonomyia* sens. str.) ..... 3

   Mid tibia without bristles on antero-ventral surface, rarely with bristles on anterior or antero-dorsal surface only; basal joint of hind tarsi without an outstanding ventral bristle near base; arista with the pubescence usually as long as basal diameter of arista (*Neopogonomyia* S. and D.) ..... 4

2. Thorax with four pairs of postsutural dorso-central bristles.

   **alpicola** Rondani

   Thorax with three pairs of postsutural dorso-central bristles ..... 2

3. Eyes separated by a distance greater than width across posterior ocelli; spines on ventral surface of mid metatarsus longer than diameter of metatarsus, metatarsus thickened; antero- and postero-ventral surfaces of mid tibia each with seven to ten bristles.

   **spinitarsus** Aldrich

   Eyes separated by a distance distinctly less than width across posterior ocelli; spines on ventral surface of mid metatarsus not as long as diameter of metatarsus, metatarsus slender; antero-ventral surface of mid tibia with one to two bristles, postero-ventral surface with four to five.

   **alpicola** Rondani

4. Hind tibia with a series of short bristles of almost equal length upon antero-dorsal surface, none of which are distinctly longer than diameter of tibia; abdomen almost cylindrical, with a slender dorso-central black line; wings yellowish, the veins scarcely darker than the membrane ..... **nitens** Stein

   Hind tibia with a series of bristles of irregular lengths, the longest very much longer than the diameter of the tibia; wings subhyaline or subfuscous, the veins black or dark brown ..... 5

5. Mid femur with a few bristly hairs on apical third of antero-ventral and postero-ventral surfaces, none of which exceed in length the diameter of the femur; hind tibia transverse at apex, not with a short blunt protuberance on ventral surface ..... **similis** sp. n.

   Mid femur with a number of bristles on apical third of antero-ventral and postero-ventral surfaces, several of which greatly exceed in length the diameter of the femur; hind tibia with a short blunt protuberance at apex on ventral surface ..... 6

6. Postero-ventral surface of mid femur with five to seven long slender bristles on apical half, the longest of which is at least twice as long as diameter of the femur, basal half of same surface with minute hairs; antero-ventral surface with long bristles on apical three-fourths of its length; dorsum of abdomen pruinescent and with poorly defined black central stripe; wings hyaline except at base ..... **minor** sp. n.

   Mid femur with long bristly hairs in a rather closely placed series from base to near apex on postero-dorsal surface, those on basal half much longer than those on apical half; antero-ventral surface with four to five long, strong bristles on apical two-fifths; dorsum of abdomen not distinctly pruinescent; wings infuscated, very noticeably so at base. **aldrichi** sp. n.

## Females

1. Mid tibia with one or more antero-ventral bristles ..... 2

   Mid tibia without antero-ventral bristles ..... 6

2. Thorax with four pairs of postsutural dorso-central bristles ..... 3

   Thorax with three pairs of postsutural dorso-central bristles ..... 4

3. Wings yellowish at base, the veins conspicuously so except at extreme base; pteropleura with one to two long erect hairs. *Arctic species* not included

   Wings fuscous at base, the veins entirely black or fuscous; pteropleura bare ..... **alpicola** Rondani

4. Mid femur without a continuous series of bristles on antero- and postero-ventral surfaces; arista with short hairs, the longest of which is equal in length to the basal diameter of the arista; frons over one-third as wide as head ..... **latifrons** sp. n.

   Mid femur with a continuous series of bristles on antero-ventral surface and another, weaker, on the postero-ventral; arista with very short pubescence ..... 5

5. Mid metatarsus about ten times as long as its greatest diameter, the ventral bristles nearly erect, and almost as long as the diameter of the metatarsus ..... **spinitarsis** Aldrich

Mid metatarsus about eight times as long as its greatest diameter, the ventral hairs directed apicad, not near as long as diameter of metatarsus ..... **alpicola** Rondani

6. Wings including the veins conspicuously yellow; mid femur with one short bristle near base and three to four near apex on antero-ventral surface ..... **nitens** Stein

Wings hyaline or slightly smoky, the veins sometimes yellowish ..... 7

7. Mid femur with one to two strong bristles beyond middle on antero-ventral surface, which are distinctly stronger than any that may be present near base of same surface; apical joint of fore tarsi as wide as the preapical at its apex ..... **minor** sp. n.

Mid femur with a bristle near base on antero-ventral surface, which is at least as strong as those near apex of same surface, the latter usually closely placed; apical joint of fore tarsi distinctly broader than preapical ..... 8

8. Apical joint of fore tarsi but little dilated; mid femur with one to two weak bristles near base on antero-ventral surface, and four to five at apex which are nearly equal in length ..... **similis** sp. n.

Apical joint of fore tarsi much dilated; mid femur with one to two very strong bristles near base and one to three much weaker bristles near apex on antero-ventral surface ..... **aldrichi** sp. n

**Pogonomyia alpicola** Rondani

1877. *Pogonomyia alpicola* Rondani, Dipt. Ital. Prod., vi, 32.

This species varies in the chaetotaxy of the thorax, having three or four pairs of postsutural dorso-central bristles, differing in this respect from most species of the subfamily in which the number of these bristles is usually very constant.

There are thirteen specimens in this collection which agree so well with some examples of *alpicola* which I have from Europe that I have no hesitation in accepting them as that species.

Locality: Beulah, New Mexico, June 28, 1902, top of range. Three males, ten females.

**Pogonomyia similis** sp. n.

This and the following three species belong, which *nitens*, Stein, to *Neopogonomyia*, all four being submitted to me under the name *aterrima* v. d. Wulp by Dr. Aldrich, and included in his paper as such. In the paper referred to is given a very full description of the principal characters of the three species, including the color

and general chaetotaxy, with the exception of the mid femora and the form of the apex of the hind tibiae, which were overlooked by Aldrich. The distinctions of value in separating the species are listed in the keys on a preceding page and are constant throughout a long series of specimens.

I have refused to recognize the specific name *aterrima* as applicable to any of the species before me, because I do not know to which of the three it may be applied, if it can be applied to any. These mountain forms are not very widely distributed as a general rule and I prefer to consider the species all distinct from *aterrima*, which was described from Mexico, until the type specimen of that species can be more fully described.

*Similis* is rather larger than *minor*, equalling *aldrichi* in size, but is not so robust as the latter. The mid femora in the male is more robust than in either of these species and is not appreciably curved, and in addition to the difference in chaetotaxy of this pair of legs the apex of the hind tibia is transverse, without a slight but distinct protuberance on ventral surface.

The females of all three species are very similar but may be separated by the characters cited in the key. Length, 4.5 to 5.5 mm.

*Type.*—♂; Beulah, New Mexico, top of range, June 28, 1902, [A. N. S. No. 6200]. *Paratypes.*—6 ♂, 5 ♀, topotypical; 1 ♀, Claremont, California, [Illinois]; 1 ♂, Tennessee Pass, Colorado, July 25, 1917, (Aldrich), [Illinois]; 1 ♂, John Smith Ranch, Colorado, July 3, 1913, [U. S. Biol. Surv.]; Bozeman, Montana, June 20, 1906; 3 ♂, 1 ♀, same locality, July 3, 1902; 1 ♀, same locality, July 7, 1902; 1 ♀, same locality, May 30, 1916, [all Montana Exp. Sta.]; 1 ♀, Gallatin Mountains, Montana, 6000 feet alt., June 1, 1914, [Montana Exp. Sta.].

I have before me one male and two females taken in Newfoundland, which either belong to this species or to one very closely allied to it.

**Pogonomyia minor** sp. n.

This species averages smaller (3.5 to 4.5 mm.) than the other two and appears to be the commonest Colorado and New Mexico form.

For characters see notes and keys under previous species.

*Type.*—♂; Beulah, New Mexico, top of range, June 28, 1902, [A. N. S. No. 6201]. *Paratypes.*—28 ♂, 18 ♀, topotypical; 1 ♂, 1 ♀, Tennessee Pass, Colorado, July 25, 1917, (Aldrich), [Illinois]; 3 ♀, Grant, Colorado, July 13; 1 ♀, same locality, July 19; 6 ♀, same locality, July 21, [all U. S. Biol. Surv.]; 1 ♂, 1 ♀, John Smith Ranger Ranch, Colorado, July 3, 1913, [U. S. Biol. Surv.]; 1 ♂, Farewell Creek, Saskatchewan, Canada, [Illinois].

**Pogonomyia aldrichi** sp. n.

An intensely black species which is more robust than *similis* and lacks the distinct pruinescence on the abdomen which is more or less conspicuous in *minor* and quite evident in *similis*. The chaetotaxy of the mid femora in both sexes serves to separate *aldrichi* from the other two. Length, 5.5 to 6.5 mm.

*Type.*—♂; Moscow, Idaho, May 22, 1913, (Aldrich), [Illinois].

**Pogonomyia latifrons** sp. n.

*Female.*—Similar to the other species in color.

Differs from *alpicola* in having the arista more distinctly hairy, and from the species with hairy arista in having a strong bristle on antero-ventral surface of mid tibia as well as a much broader frons, the distance from anterior ocellus to base of antennae about equal to width of frons at anterior margin. The mid femur has one strong bristle near base of antero-ventral surface. Length, 4.5 mm.

*Type.*—♀; Tennessee Pass, Colorado, July 24, 1917, (Aldrich), [Illinois].

## Subfamily Coenosiinae

The characters which distinguish this family from Phaoniinae are very few. In fact several genera that have been at various times placed in Coenosiinae are now considered as part of Phaoniinae, leaving in the former only *Schoenomyza*, *Coenosia*, *Macrorchis*, *Allognotha*, *Hopologaster* and *Caricea* of the North American fauna. *Dexiopsis* has been recorded from North America, but I consider the species so recorded does not belong to that genus.

### ALLOGNOTHA Pokorny

This genus previously has not been recorded from North America. I have before me specimens of the genotype, *agromyzina* Zetterstedt, which differs structurally from the species before me

in having the antennae much longer and the third joint acute at apex on upper side. The European species is entirely black, whereas the new one is testaceous.

From all other genera in Coenosiinae *Allognotha* may be separated by the discontinuance of costa at apex of third vein.

**Allognotha semivitta** sp. n.

*Male* and *Female.*—Yellowish testaceous, opaque. Head paler than rest of body, the face nearly white; center portion of occiput grayish. Thorax sometimes entirely yellow, but normally with gray or fuscous markings as follows: Dorsum with four vittae, the outer pair very short, not extending cephalad of the suture, the median pair extending from anterior margin to penultimate pair of dorso-centrals, postnotum with center broadly dark, mesopleura, sternopleura and hypopleura each with a large dark spot. Legs entirely testaceous. Wings clear, veins yellow.

Frons slightly less than one-third the width of head, rounded in profile; ocellar bristles very strong; orbitals three to four, antennae short, not extending much below middle of face; eyes decidedly divergent below; face vertical; parafacials distinct in profile, of equal width throughout their length; vibrissae strong; mouth margin with six to nine strong black bristles; arista with short hairs. Presutural acrostichals irregularly two-rowed; scutellum with four strong bristles. Legs with bristles arranged as in normal *Coenosia* species, but rather shorter and stouter. Hypopygium small; fifth sternite with a deep central incision, dividing the segment into two long processes. Veins 3 and 4 distinctly divergent at apices. Length, 3 to 4.5 mm.

*Type.*—♂; Meredosia, Illinois, August 19, 1917, [Illinois]. *Paratypes.*—2 ♀, topotypical, May 29; 2 ♂, 1 ♀, Havana, Illinois, August 30 to 31; 1 ♀, labelled "N. Ill."

The specimens with the exception of the last one were taken by Mr. C. A. Hart and the writer in 1917, while collecting in the sand regions at the two places named.

The species bears a strong resemblance to *Coenosia modesta* Loew, which is, however, a true *Coenosia*.

The type is in the collection of the State Natural History Survey of Illinois, and a paratype is deposited in the Academy of Natural Sciences of Philadelphia.

**Coenosia fraterna** sp. n.

*Male* and *Female.*—Black, slightly shining. Head black, frons, face, cheeks, and apex of second antennal joint whitish gray pruinose; antennae, proboscis and palpi black. Thorax whitish pruinescent, with three faint brown vittae. Abdomen colored as thorax, with a pair of brown spots on dorsum of segments two, three and four. Legs black, bases of tibia reddish, more broadly so in female. Wings clear. Calyptra white. Halteres yellowish.

Frons distinctly longer than broad, parallel-sided; each orbit with three long bristles and a weak hair between the forward pair; antennae not as long as face, third joint slender, twice as long as second, sharply angulate at apex on upper side; arista pubescent; face vertical in profile, the orbits narrow, but distinct on their whole length in profile; cheek not twice as high as width of parafacial (orbit) in profile, margin with a series of long hairs, vibrissal angle not elevated; vibrissa long, one bristle above it. Presutural acrostichals weak, two-rowed. Abdomen rather short, subcylindrical, all segments with discal bristles in transverse series, those on segments three and four very long; fifth sternite with lateral processes short, somewhat angulate at apices. Fore tibia with one posterior median bristle; mid tibia with two bristles at same distance from base, one antero-dorsal and one postero-dorsal; mid femora with a few widely placed bristles on postero-ventral surface; hind femur with long widely placed bristles on antero-and postero-ventral surfaces; hind tibia with two bristles, one antero-dorsal and one antero-ventral, the latter much nearer to apex than the former. Wing venation similar to that of *tibialis* Stein but the sixth vein is shorter, almost absent, and the apex of wing is not pointed as in that species, so that the apices of veins 3 and 4 are almost in vertical line, whereas in *tibialis* the third vein is almost in extreme apex, while the fourth is much caudad of it. Length, 2.75 to 3.5 mm.

*Type.*—♂; Milbrae, San Mateo County, California, March 20, 1908, [A. N. S. No. 6202]. *Paratypes.*—7 ♀, Highrolls, New Mexico, June 2 and 10, 1902; Berkeley Hills, California, March 14, 1908; Troy, Idaho, May 31, 1908; Beulah, New Mexico, June 28, 1902; Blitzen River, Oregon, July 6, 1906, [Illinois].

There are also before me fifteen female specimens from the collection of the United States Bureau of Biological Survey taken at Grant, and John Smith Ranger Ranch, Colorado, July 3 and 20 to 21 and August 20.

The foregoing species very closely resembles *tibialis* Stein in color, but differs in having the third antennal joint slender, the parafacials distinct in profile and the mid tibial bristles at same distance from base.

**Coenosia ovata** Stein

1897. *Coenosia ovata* Stein, Berl. Ent. Zeit., xlii, 263.

In the original description of this species Stein makes no mention of the peculiar lobe-like protuberance of the anal angle of the wing in the male of this species, which at once separates it from any so far recorded from North America.

There are three specimens in the collection before me from the following localities: one male, Highrolls, New Mexico, June 11,

1902; one female, same locality, May 31, 1902; one female, Alamogordo, New Mexico, May 8, 1902.

**Coenosia basalis** Stein

1897. *Dexiopsis basalis* Stein, Berl. Ent. Zeit., xlii, 259.

This species was originally described by Stein as a *Dexiopsis*, but it does not belong to that genus, having but one pair of presutural dorso-centrals, the hypopygium very small, and the sixth vein not longer than in normal *Coenosia* species.

If I am correct in my interpretation of the limits of the species it is quite variable in color, the palpi and front coxae being sometimes entirely dark, and varying to entirely pale, while the mid and hind femora are usually conspicuously blackened at apices and vary to entirely yellow. The abdomen is sometimes conspicuously yellow at base, but in the specimens from New Mexico the color is entirely gray and the lateral spots on dorsum are absent. There is a constancy in chaetotaxy, and other characters, that forces me to the conclusion that I have before me not several species, but one which is variable in color.

From other species in the genus, *basalis* may be readily separated by the presence of a long postero-dorsal bristle at middle on hind tibia, and by the rather short stout abdomen, which has usually a central vitta and paired spots on dorsum, while the fifth sternite is short, with a shallow central incision and is normally almost entirely hidden.

Localities: Alamogordo, New Mexico, April 8 and 22, and May 3, 1902; Clouderoft, New Mexico, June 18, 1902, two males, two females.

**Coenosia setigera** sp. n.

*Male.*—Black, densely pruinescent. Head black, interfrontalia opaque black, ocellar triangle and orbits brownish gray pruinose, face, facial orbits, and cheeks with white pruinescence; antennae black; palpi brown. Thorax slightly shining, without vittae. Abdomen with a pair of faint brown spots on dorsum of segments two, three and four which are very large, and contiguous or almost so centrally, so that the dorsum appears to have a broad brown central vitta posteriorly; fifth sternite and hypopygium black. Legs yellow, mid and hind coxae grayish, tarsi black. Wings clear, veins dark brown. Calyptra white. Halteres yellow.

Frons almost twice as long as wide and nearly one-third the width of head; ocellar triangle short, not extending to middle of frons; orbits narrow, about one-fourth as wide as interfrontalia, the bristles very long, four in number, with

one to two interspersed long hairs; antennae shorter than face, third joint not over twice as long as second, slightly angulate at apex on upper side; arista slender, with distinct pubescence; parafacial distinct in profile, slightly narrower than third antennal joint, and half as wide as height of cheek, the latter with five to six long marginal hairs, a very long vibrissa and one bristly hair above the latter. Presutural acrostichals two-rowed, sparse; bristles of thorax much longer than those of abdomen. Fifth abdominal sternite with a shallow, rounded posterior excision; hypopygium small. Legs slender; fore tibia with one posterior bristle; mid femur with three to four anterior and postero-ventral bristles on basal half; mid tibia with the usual two bristles at nearly the same height; hind femur with four very long, widely spaced bristles on antero-ventral surface, between which there are much shorter setulose hairs; hind tibia with one comparatively short antero-ventral bristle, the antero-dorsal bristle and the preapical dorsal one-half as long as tibia and very slender. Inner cross-vein at four-sevenths from base of discal cell; last section of fourth vein twice as long as preceding section; apices of third and fourth veins almost in vertical line. Length, 2.75 mm.

*Type.*—♂; Beulah, New Mexico, top of range, June 28, 1902, [A. N. S. No. 6203].

This species resembles *flavicoxa* Stein in general appearance, but that species differs in coloration of legs, bristling of hind femora and tibiae, and in venation.

**Coenosia argentata** Coquillett?

1904. *Coenosia argentata* Coquillett, Invert. Pac., i, 33.

A female in very poor condition agrees fairly well with males of this species before me, but has the legs paler, and the bristles shorter. I refer the specimen here with some doubt.[3]

Locality; San Francisco, California, August 7, (F. E. Blaisdell), 1908.

**Coenosia lata** Walker

1853. *Coenosia lata* Walker, Dipt. Saund., 368.

One female, Cloudcroft, New Mexico, June 16, 1902; one female, San Francisco, California, August 7, (F. E. Blaisdell), 1908.

**Coenosia** sp?.

One female in very poor condition; may possibly be an immature example of *fraterna* sp. n.

Locality; Mesa Grande, Sonoma County, California, (J. P. Baumberger), June, 1908.

[3]Since writing the above I have received two male specimens of *argentata*, taken at San Francisco, California, March 30, 1909, which are now in the Academy collection. These agree very closely with the female referred to above.

**Macrorchis majuscula** (Coquillett)

1904. *Coenosia majuscula* Coquillett, Invert. Pac., i, 34.

There is one female of this species in the collection.

Locality; San Francisco, California, August 7, 1908, (F. E. Blaisdell).

The only other species of this genus which I have seen from North America is *antica* Walker (*insignis* Stein). The latter differs from Coquillett's species in having but one pair of presutural dorso-centrals. Both species have two long, closely approximated bristles at middle of hind tibia, one anterior and one antero-dorsal. There is in the specimen of *majuscula* before me a weak median postero-dorsal bristle on the hind tibia, which is not mentioned by Coquillett and which does not appear in any of my specimens of *antica*.

**SCHOENOMYZA** Haliday

There are only three species of this genus listed from North America. One of these, *pulicaria* V. d. Wulp, I have not seen.

I have drawn up a key which summarizes the principal differentiating characters of the males of the species before me, which should prove useful to students of the group. It is possible that *chrysostoma* and *dorsalis* are merely extreme forms of but one species, but there appear to be several forms distinguishable by color, occurring in the west, as shown in this paper.

*Key to Species*

Males

1. Frons entirely ochreous; each orbit with three bristles.....2
   Frons with anterior half conspicuously whitened; each orbit with two bristles.....3
2. Cross-veins of wings with conspicuous spot-like infuscation; last section of fourth vein only slightly longer than proceding section, and much shorter than the width of wing at middle.....**aurifrons** sp. n.
   Cross-veins of wings faintly or not at all infuscated; last section of fourth vein more than twice as long as preceding section, and at least as long as width of wing at middle.....**convexifrons** sp. n.
3. Upper half or more of face black or blackish brown...**chrysostoma** Loew
   Face entirely ochreous.....4
4. Face sulphur yellow, not, or very little, darker than cheeks; upper portion of second and third antennal joints reddish yellow; when seen from above the ocellar triangle is continued as an opaque black wedge to, or very nearly to, anterior margin of frons.
   **dorsalis** var. **sulfuriceps** var. n.
   Face orange yellow, distinctly darker than cheeks, antennae black.....5

5. Frons when seen from above with the ocellar triangle carried forward in the form of an opaque black wedge to, or almost to, anterior margin, dividing the silvery white portion into two separate areas.

**dorsalis** Loew

Frons when seen from above with the anterior half entirely silvery white, the anterior wedge-like extension of ocellar triangle never distinct, and rarely darker than surrounding areas.

**dorsalis** var. **partita** var. n.

**Schoenomyza convexifrons** sp. n.

*Male.*—Black, opaque, covered with dense olive-gray pruinescence. Head black, gray pruinose on occiput, covered with dense golden pruinescence on frons, face and cheeks, when viewed from in front the ocellar triangle, and upper half of each orbit appear black-brown; antennae black, with inconspicuous whitish pruinescence, most distinct at apex of second joint; proboscis black, palpi fuscous. Thoracic dorsum with four brown vittae, two between the rows of dorso-centrals, and one on each side between the dorso-centrals and intra-alars; in front of scutellum on mesonotum there is a short brown streak between the median pair of vittae, and on disc of scutellum there is a brown mark. Abdomen with a pair of large, poorly defined brownish black spots on disc of all dorsal segments. Legs black. Wings clear, veins black, cross-veins hardly more conspicuous than the other veins. Calyptra and halteres whitish.

Frons in profile slightly convex, at vertex a little over half the width of head, narrowed anteriorly, its central length about equal to its greatest width; ocellar bristles long and strong; each orbit with three bristles, the upper one strongest, in addition to the bristles there are numerous short hairs on orbits; antennae below the average size for the genus, third joint about twice as long as wide, sharply angulated at apex on upper side; arista tapered, almost nude; face in profile slightly receding, parafacials narrow; cheek as high as width of third antennal joint; one short bristle above the strong vibrissa. Acrostichals weak, arranged in pairs from anterior to posterior margin of disc, usually six pairs present (two+four). Chaetotaxy of legs as in *chrysostoma* Loew. Wings narrow; last section of fourth vein at least twice as long as preceding section, penultimate section of costa longer than penultimate section of fourth vein; outer cross-vein at more than its own length from apex of fifth.

*Female.*—Differs in color from the male in having the frons, face, and cheeks pale olive-gray pruinose, and the cross-veins of the wings noticeably infuscated. Length, *male*, 3 mm., *female*, 4 mm.

The frons is broader than in the male and slightly less buccate. In other respects the sexes agree very closely.

*Type.*—♂; Milbrae, California, March 20, 1908. [A. N. S. No. 6204]. *Paratypes.*—4 ♂, 2 ♀, topotypical.

**Schoenomyza aurifrons** sp. n.

*Male.*—Black, densely covered with olive-gray pruinescence. Back of head with olive-gray pruinescence, frons, face, and cheeks with golden brown pruinescence; antennae black, apex of second joint and inner and outer surfaces of third on upper half with silvery white pruinescence; proboscis glossy black; palpi yellow. Dorsum of thorax not vittate. Abdomen with a small pair of black spots on dorsum of second visible segment, and a larger pair on dorsum of third and fourth which are glossy black. Legs black. Wings slightly milky, both cross-veins broadly infuscated. Calyptra white. Halteres yellow.

Frons gently rounded in profile, distinctly over half as wide as head at vertex, much narrowed anteriorly; cephalic chaetotaxy similar to that of preceding species, but there is no bristle above vibrissa in type. Chaetotaxy of thorax and legs as in preceding species, the wings noticeably broader, with venation differing as indicated in key to species, and the apices of third and fourth veins more noticeably convergent. Length, 2.5 mm.

*Type.*—♂; Mexico City, Mexico, [Coll. Illinois].

**Schoenomyza chrysostoma** Loew

1869. *Schoenomyza chrysostoma* Loew, Berl. Ent. Zeit., xiii, 177. (Cent., ix, 86.)

There are a number of specimens of both sexes amongst the material which I consider referable to this species, although the face of the male is not black, showing only a gradual darkening towards base of antennae. In one of my Illinois specimens I find the same variation from type.

Localities: Cloudcroft, New Mexico, June 16 and 20, 1902, three specimens; Highrolls, New Mexico, May 29, 1902, one specimen; East Las Vegas, New Mexico, June 24, 1902, one specimen; top of Las Vegas range, Beulah, New Mexico, June 28, 1902, five specimens.

**Schoenomyza dorsalis** Loew

1872. *Schoenomyza dorsalis* Loew, Berl. Ent. Zeit., xvi, 95. (Cent., x, 73.)

There is one male in the material which agrees in all particulars with specimens from Illinois, except that the thoracic dorsum is not so distinctly vittate, but the specimen has been damaged slightly, so that the difference may be due to that fact.

Locality; Beulah, New Mexico, June 28, 1902, top of range.

**Schoenomyza dorsalis** var **sulfuriceps** var. n.

*Male.*—Similar in color to *dorsalis* Loew except that the face is entirely sulphur yellow, and not or but little darker than the cheeks, and the antennae are broadly reddish yellow above. In other respects it agrees very closely with

typical *dorsalis* and there is little doubt in my mind that it is but a variety of that species.

*Female.*—This sex is very similar to typical *dorsalis* females, but in the latter the face is usually appreciably darker than the cheeks and the thorax is more distinctly vittate. Length, 2.25 to 3.25 mm.

*Type.*—♂; Berkeley Hills, California, March 22, 1908. [A. N. S. No. 6205]. *Paratypes.*—2 ♂, topotypical; 1 ♂, 6 ♀, Yosemite Valley, California, May 22, 1908; 3 ♂, Milbrae, California, April 20, 1908; 1 ♂, 1 ♀, Moscow, Idaho, June 2, 1908.

**Schoenomyza dorsalis** var. **partita** var. n.

*Male.*—Differs from *dorsalis* in having the anterior half of frons entirely silvery, the ocellar triangle being silvered at apex, so that when seen in front the black wedge-like anterior extension, which separates the white portion of frons into two areas in *dorsalis*, is absent. In other respects the specimens agree very closely with typical *dorsalis*, but sometimes the face is but little darker than the cheeks.

*Female.*—Almost inseparable from typical *dorsalis;* the only difference appears to be in the color of the frons which resembles that of the male, though without silvery pruinescence. Length, 2.75 to 4 mm.

*Type.*—♂; Berkeley Hills, California, April 11, 1908, [A. N. S. No. 6206]. *Paratypes.*—1 ♂, 3 ♀, topotypical; 6 ♂, 10 ♀, Lagunitas Cañon, California, March 29, 1908; 2 ♀, Berkeley Hills, March 22, 1908; 3 ♀, Milbrae, California, March 20, 1908; 1 ♀, Troy, Idaho, May 31, 1908; 1 ♀, Sarita, Texas, November 29, 1911, [Illinois].

## Subfamily Hydrotaeinae

There are representatives of two genera of this subfamily in the collection.

### HYDROTAEA R.-D.

Several species of this genus are very annoying to man and cattle in this country and Europe. The first three species in this collection occur in Europe as well as in North America.

**Hydrotaea occulta** Meigen

1826. *Anthomyia occulta* Meigen, Syst. Besch., v, 133.

One male, one female, Lagunitas Cañon, Marin County, California, March 29, 1908.

**Hydrotaea armipes** Fallen

1823. *Musca armipes* Fallen, Dipt. Suec., Muse., 75.

This species, the larvae of which are found in manure, is the most widely distributed of the genus, occurring throughout North America and Europe.

There are specimens in the collection with data as follows: one male and two females, Alamogordo, New Mexico, April 14, 15, 25, 1902; one female, Clouderoft, New Mexico, May 21, 1902; one male, one female, Lagunitas Cañon, Marin County, California, March 29, 1908; one female, Mesa Grande, Sonoma County, California, July 12, 1908; two females, Troy, Idaho, May 31, 1908; and one female, Moscow, Idaho, June 2, 1908.

**Hydrotaea dentipes** Fabricius

1805. *Musca dentipes* Fabricius, Syst. Antil., 303.

Three females that appear to be undoubted *dentipes* Fabricus with the following data: Clouderoft, New Mexico, May 22, 24, and 26, 1902.

In addition to the lack of bristles at base of ventral surfaces of mid femora, the above specimens have the four to five bristles at apex of antero-ventral surface of hind femur very much more closely placed than in *hough*i Malloch, and the postero-dorsal bristle is usually about one-third from apex of tibia, whereas in *hough*i it is usually two fifths from apex.

This is the first time I have seen what I consider true *dentipes* from North America.

**Hydrotaea unispinosa** Stein

1897. *Hydrotaea unispinosa* Stein, Berl. Ent. Zeit., xlii, 165.

One female which agrees in all particulars with the Colorado type in the Hough collection.

Locality; Clouderoft, New Mexico, May 24, 1902.

**Hydrotaea** sp.?

One female closely resembling *palaestrica* Meigen.

Locality; Clouderoft, New Mexico, May 27, 1902.

**Hydrotaea** sp.?

One female resembling *unispinosa* Stein.

Locality; Troy, Idaho, May 31, 1908.

**Hydrotaea metatarsata** Stein

1897. *Hydrotaea metatarsata* Stein, Berl. Ent. Zeit., xlii, 166.

One small female of this species.

Locality; Alamogordo, New Mexico, April 22, 1902.

**OPHYRA** R.-D.

There are two species of this genus found in the United States, one of which is confined to the southern and tropical American states; the other, which is represented in the material before me, occurs in Europe and North America, extending its range well into Canada.

**Ophyra leucostoma** Wied

1817. *Anthomyia leucostoma* Wiedemann, Zool. Mag., i, 82.

One male, Redwood Cañon, Marin County, California, May 17, 1908; one female, Berkeley Hills, Alameda County, California, April 20, 1908.

Subfamily Lispinae

There is but one genus in this subfamily, which may be separated from any other by the presence of a clump of hairs on center of pteropleura, the dilated palpi, widely separated eyes and hairy parafacials in both sexes, very large lower calypter, incomplete sixth vein, the absence of the prealar bristle, and lack of hairs on under surface of scutellum.

**Lispa tentaculata** DeGeer

1776. *Musca tentaculata* DeGeer, Ins. vi, 86.

There are five specimens of this widely distributed species in collection.

Localities: one male, Lagunitas Cañon, Marin County, California, March 29, 1908; one male, one female, Alamogordo, New Mexico, May 1, 1902; two females, same locality, May 5, 1902.

Subfamily Fanniinae

*Fannia* is the only genus of this subfamily represented in this collection. I have a key for the identification of the species of this genus in manuscript and I hope to publish it shortly, including all species in this and other papers by the writer, and those described or recorded by Stein.

**Fannia benjamini** Malloch

1913. *Fannia benjamini* Malloch, Proc. U. S. Nat. Mus., xliv, 625, pl. 77, f. 9.

There are five specimens in the collection from Alamogordo, New Mexico, with dates as follows: three males, April 19, 1902, two females, May 7 and 8, 1902.

The species was originally described from specimens collected in California, Arkansas, and Cuba. I have since seen it from Brownsville, Texas, and Graham Mountains, Arizona.

**Fannia femoralis** Stein

1897. *Homalomyia femoralis* Stein, Berl. Ent. Zeit., xlii, 282.

Three males taken at Alamogordo, New Mexico, April 19 and 23, 1902.

**Fannia spendida** Stein

1897. *Homalomyia splendida* Stein, Berl. Ent. Zeit., xlii, 170.

One male; Mesa Grande, Sonoma County, California, June 1908, (J. P. Baumberger).

**Fannia trianguligera** sp. n.

*Male.*—Black, slightly shining. Face, orbits, and cheeks silvery. Abdomen with dense bluish gray pruinescence on dorsum, second, third and fourth segments each with a large black triangle, the apex of which is carried to anterior margin, fifth segment with a black dorso-central stripe. Legs black. Calyptra white. Halteres yellow.

Eyes bare, separated by slightly more than width across posterior ocelli; arista bare; palpi stout, as long as apical portion of proboscis. Thorax with acrostichals two-rowed in front, becoming three-rowed just before suture. Hypopygium small, not protruded. Legs similar to *incisurata* Zetterstedt, differing noticeably only in the bristling of the mid femur, the antero-ventral series of bristles being much longer than in that species, beginning at base with bristles which are at least as long as diameter of femur and continuing to apex, gradually becoming closer and shorter; the postero-ventral series is much denser, and more regular than in *incisurata* and begins at base, while many of the bristles of apical third of series are distinctly curved at apex, almost fishhook-like; the mid tibia is also more noticeably swollen on apical half than in *incisurata*, the latter having the tibia gradually thickened from base to apex, whereas in the present species it is appreciably attenuated to beyond middle and then rather abruptly thickened. The hind legs are almost the same in form and chaetotaxy in both species, but the bristles on antero-ventral and postero-ventral surfaces are weaker and less numerous in *trianguligera* than in *incisurata*. Calyptra unequal.

*Female.*—Similar to the female of *scalaris* Fabricius and *incisurata*. Differs only in having the interfrontalia red-brown, the orbits very broad, each as

wide as interfrontalia, rounded off in front; legs entirely black; the antero-dorsal bristle present on fore tibia but weak; thoracic chaetotaxy as in male. Length, 4.5 to 5.5 mm.

*Type.*—♂; Alamogordo, New Mexico, May 6, 1902, [A. N. S. No. 6207]. *Paratypes.*—2 ♀, May 6; 2 ♂, 1 ♀, May 7; 1 ♂, May 8, topotypical.

**Fannia plebeia** sp. n.

*Male.*—Deep black, shining. Orbits densely white pruinescent, face less densely so. Thorax with faint grayish pruinescence on sides and posteriorly. Abdomen with the usual triangular black dorsal mark on each segment, the lateral extensions of which are less distinct than the central portion. Legs black. Wings slightly smoky. Calyptra brownish yellow. Halteres with knobs yellowish.

Eyes bare, separated at narrowest part of frons by width across posterior ocelli; antennae distinctly shorter than face, third joint broad; arista bare; cheek linear. Presutural acrostichals moderately long, two-rowed. Abdomen broad; hypopygium small; fore tibia without median bristle; mid femur very slightly attenuated at apex; antero-ventral surface with a series of sixteen to eighteen bristles extending from about one-fourth from base to apex, the largest one not as long as diameter of femur, the series becoming closer and shorter to apex and at no point interrupted; postero-ventral surface with two to three series of bristles which begin near base and run to apex, one series distinctly stronger than the others, and all of them longer than the antero-ventral series; mid tibia swollen on apical half, the basal half slender, pubescence erect, distinct but not conspicuous; bristles normal; hind femur with three to five bristles on apical half of antero-ventral surface, the postero-ventral surface with short hairs on basal half; hind tibia with three bristles, one antero-ventral, one antero-dorsal, and one postero-dorsal, the latter stronger than the others and the preapical dorsal. Hind coxa with a bristle at apex above. Lower calyptra distinctly protruded. Length, 4.5 mm.

*Type.*—♂; Beulah, New Mexico, June 29, 1902, [A. N. S. No. 6208].

This species bears a resemblance to *trianguligera* sp. n., but differs in chaetotaxy of mid and hind femora and tibiae.

**Fannia minutipalpis** Stein

1895. *Homalomyia minutipalpis* Stein, Berl. Ent. Zeit., xl, 106.

Seven females taken at Clouderoft, New Mexico, on dates as follows: one specimen, May 21, 1902, five specimens, May 27, 1902, and one specimen, June 16, 1902.

A common and widely distributed species occurring in North America and Europe.

The male standing as *polychaeta* Stein in the Hough collection and named as such by Stein is *minutipalpis*, so that the former species cannot be considered as occurring in this country until an authentic specimen is obtained.

**Fannia fuscula** Fallen

1820. *Musca fuscula* Fallen, Dipt. Suec., Musc., 86.

One male from Lagunitas Cañon, Marin County, California, March 29, 1908.

**Fannia laevis** Stein

1897. *Homalomyia laevis* Stein, Berl. Ent. Zeit., xlii, 174.

One female of this species in collection agrees with the type female in all particulars. The species has in both sexes a single bristly hind coxal posterior hair, and the lower calyptra distinctly produced beyond the upper.

Locality; El Paso, Texas, March 31, 1902.

**Fannia spathiophora** sp. n.

*Female.*—Black, shining. Head with slightly iridescent pruinescence, that of frons when seen from in front almost pearlaceous. Thorax unstriped, more distinctly pruinescent than abdomen. Legs black, bases of fore tibiae pale. Wings clear, veins brown, yellow basally. Calyptra whitish yellow. Halteres yellow.

Frons slightly over one-third the head-width, orbit at widest part slightly narrower than interfrontalia at that part, bristles moderately long, each orbit with numerous short setulose hairs; antennae reaching almost to mouth margin, third joint broad; arista with short pubescence; cheek linear; proboscis short and thick; palpi short, leaf-like, at broadest part as broad as third antennal joint. Acrostichals strong, four to five pairs in front of suture; lower calypter smaller than upper, but of moderate size. Fore tibia unarmed at middle; mid tibia with one antero-dorsal and one postero-dorsal bristle; hind femur with two to three widely placed bristles on apical half of antero-ventral surface; hind tibia with three bristles, one antero-ventral, one antero-dorsal, and one postero-dorsal, the latter the strongest; hind coxae bare above on posterior margin. Last section of fourth vein nearly three times as long as preceding section; apical sections of veins 3 and 4 slightly convergent. Length, 3 to 3.75 mm.

*Type.*— ♀ ; Gold Rock, Rainy River District, Ontario, Canada, July 21, 1905, (H. H. Newcomb), [Illinois]. *Paratypes.*—1 ♀, topotypical, [Illinois]; 1 ♀, Beulah, New Mexico, June 29, 1902.

The very conspicuously dilated palpi separate this species from any other known to me.

There is a European species which must closely resemble this one in structure of the palpi, *latipalpis* Stein, but the lower calyptter projects beyond the upper in the latter. It is known only in the male sex.

The species was already known to me when the present collection was received.

**Fannia** sp.?

There is a female specimen in collection, from Cloudcroft, New Mexico, May 23, 1902, which bears a strong resemblance to that of *polychaeta* Stein, but I prefer to have it without specific identification until I can examine more specimens.

### Subfamily Anthomyiinae

The genera of this subfamily are very poorly defined, there being no published keys or descriptions which serve to separate accurately the genera *Phorbia*, *Pegomyia*, *Hylemyia*, *Chortophila*, *Eremomyia*, and some others. The arbitrary characters used by the older authors have resulted in many cases, in a distinctly unnatural grouping and a thorough revision of generic concepts is essential.

I have used the generic names *Pegomyia* and *Hylemyia* in this paper, but hope soon to publish an accurate synopsis of generic characters for the group, the key herein presented being drawn up to cover only the genera in this paper.

#### *Key to Genera Here Treated*

1. Lower calypter distinctly protruded beyond upper ..... 2
   Lower calypter not protruded beyond upper ..... 6
2. Arista plumose; abdomen subcylindrical in male .... **Hydrophoria** R.-D.
   Arista pubescent or bare ..... 3
3. Propleura hairy above humerus ..... **Anthomyia** Meigen
   Propleura bare except just above coxa ..... 4
4. Hypopleura hairy on upper margin in front of spiracle .. **Calythea** S. and D
   Hypopleura bare ..... 5
5. Mid tibia with a strong bristle on antero-ventral surface near middle.
   **Egle** R.-D.
   Mid tibia without a bristle on antero-ventral surface at middle.
   **Pegomyia** R.-D.
6. Post humeral bristle duplicated ..... **Eremomyia** Stein
   Post humeral bristle single ..... 7

7. Frons in both sexes narrow, in the female without cruciate frontal bristles and the lower supraorbital bristle not directed forward, or very weak and but little proximad of anterior ocellus; face and frons buccate, the parafacials in profile as wide or wider than the third antennal joint, abdomen in male cylindrical; the hypopygium very small.

**Hammomyia** R.-D.

Frons in male usually narrow, in female nearly or quite one-third as wide as head, the lower supraorbital usually very strong and situated nearly midway between anterior ocellus and anterior margin of frons; face and frons rarely buccate, the parafacials in profile usually less than the width of the third antennal joint; abdomen sometimes subcylindrical

**Hylemyia** R.-D.

The distinction between the last two genera is not very clear in the males, some of the species of *Hylemyia* resembling *Hammomyia* very closely, but the females are readily separated and with a little care the males may also be distinguished.

### HYDROPHORIA R.-D.

The members of this genus which I have seen possess the following characters: eyes bare, narrowly separated in male, widely separated in female, the lower supraorbital bristle in female directed forward; arista long haired; prealar bristle present; abdomen in male subcylindrical; fifth sternite with two long processes; lower calypter much larger than upper.

**Hydrophoria subpellucida** sp. n.

*Male* and *female*.—Black, slightly shining, covered with dense whitish gray pruinescence. Head black, orbits and cheeks silvery pruinose; frontal triangle reddish brown; antennae black, second joint slightly reddish at apex; palpi blackish brown. Thorax when viewed from in front with four subcontiguous black vittae anteriorly, when viewed from behind with five black vittae, the areas between the vittae pale gray and when seen from in front assuming a black appearance, reversing the black and gray arrangement Abdomen yellow on basal half, covered with dense whitish pruinescence, and with a broad, central black vitta. Legs pitchy colored, the bases of tibiae pale, yellowish. Wings hyaline. Calyptra white. Halteres yellow.

*Male*.—Eyes separated by about the width of anterior ocellus; parafacials protruded in profile about as far as two-thirds the width of third antennal joint; arista very long plumose both above and below; cheek about one-eighth as high as eye, marginal bristles in a single row. Thorax with two to three pairs of presutural acrostichals; prealar bristle about half as long as the bristle behind it; hypopygium bare. Abdomen short, subconical; processes of fifth sternite short, rounded apically, with rather dense, short black hairs, and a few long apical bristles. Fore tibia with one antero-dorsal and one posterior

bristle; mid femur with three to five bristles on basal half of postero-ventral surface; hind femur with six to eight widely spaced bristles on whole length of antero-ventral surface and one to two about middle of postero-ventral; hind tibia with two to three antero-ventral, seven to nine short antero-dorsal, and two postero-dorsal bristles. Costal thorn short; outer cross-vein bent; last sections of veins 3 and 4 subparallel.

*Female.*—Differs from the male in having the eyes separated at vertex by one-third the width of head, each orbit nearly one-half as wide as interfrontalia, the latter with a pair of cruciate bristles, and the abdomen more abruptly pointed at apex. Length, 4.5 to 6 mm.

*Type.*—♂; Alamogordo, New Mexico, April 30, 1902, [A. N. S. No. 6209]. *Paratypes.*—2 ♂, 2 ♀, topotypical, April 30, May 5 and 15.

This species resembles *ruralis* Meigen, a European species, in coloration, but differs in chaetotaxy of hind tibia and some other characters.

**Hydrophoria divisa** Meigen

1826. *Anthomyia divisa* Meigen, Sys. Besch., v. 99.

Two males and three females, Berkeley Hills, Alameda County, California, April 20, 1908; two females, Redwood Cañon, Marin County, California, May 17, 1908.

A European species which is widely distributed throughout North America.

**Hydrophoria uniformis** sp. n.

*Male* and *female.*—Black, almost glossy. Head black, frons, orbits, face, and cheeks in both sexes with silvery pruinescence, interfrontalia in female appearing opaque black when seen from above; antennae and palpi black. Dorsum of thorax with three broad black vittae. Abdomen with a slender black dorso-central stripe and black anterior and posterior margins to segments. Legs black. Wings clear, veins black. Calyptra white. Halteres yellow.

*Male.*—Eyes separated by width of anterior ocellus; antennae shorter than face, third joint one and one-half times as long as second; arista plumose on basal half, the longest hairs about equal in length to width of third antennal joint; parafacials in profile about half as wide as third antennal joint, the latter equal in width to height of cheek. Thorax with chaetotaxy as in *divisa* Meigen, presutural acrostichals irregularly four-rowed, weak. Abdomen subcylindrical, tapered apically; fifth sternite deeply cleft centrally, the processes with rather long woolly hairs along inner half, with longer, slender, curled, bristly hairs on disc and at apex. Fore tibia usually with two bristles, a weak one on antero-dorsal surface and a strong one on posterior; mid femur with three to five slender bristles on basal half of postero-ventral surface; mid tibia with one antero-ventral, one antero-dorsal, three to four postero-dorsal

(in an irregular series) and one to two postero-ventral bristles; hind femur with six to eight widely placed bristles on the entire length of antero-ventral surface and three to four on basal half of postero-ventral; hind tibia with two to four antero-ventral, seven to nine unequal sized antero-dorsal, and three long posterior bristles. Veins 3 and 4 distinctly convergent apically; outer cross-vein oblique, distinctly curved.

*Female.*—Eyes separated by one-third the head-width; orbits one-fourth as wide as interfrontalia, almost bare except for the bristles; cruciate bristles strong. In other respects similar to male. Length, 4.5 to 5.25 mm.

*Type.*—♂; Dubois, Illinois, May 23 to 25, 1917. [Illinois]. *Paratypes.*—1 ♀, topotypical, [Illinois]; numerous specimens of both sexes from Urbana, Illinois, April 5 to 7, 1909; Savoy, Illinois, March 26, 1917; Beltsville, Maryland, Plummer's Island, Maryland, April to August inclusive.

The types are in the collection of Illinois State Natural History Survey, a pair of the Urbana paratypes are in the collection of the Academy of Natural Sciences of Philadelphia, and the Maryland specimens are in the collection of the United States Bureau of Biological Survey.

This species is smaller than *divisa* Meigen and *ambigua* Meigen, resembling the latter in having the hypopleura bare, but it is smaller than that species, has the dorsal abdominal stripe uniform in width on its whole length and has the eyes less widely separated.

### ANTHOMYIA Meigen

I consider as belonging to this genus only those species that have the propleura hairy cephalad and slightly ventrad of the spiracle, and the lower calypter distinctly projecting.

**Anthomyia pluvialis** Linné, var.

1761 *Musca pluvialis* Linnaeus, Faun. Suec., (2), 455.

One female in collection agrees in color with several I have from Illinois, Massachusetts, and Virginia. These specimens differ from typical *pluvialis* in having the dorsum of thorax with a brown vitta on each side of middle, instead of the five black spots that are present in the former. It is possible that the form here recorded is distinct from *pluvialis*, but I have no males and hesitate to give a definite opinion. Locality; Cloudcroft, New Mexico, June 16, 1902.

**CALYTHEA** S. and D.

This genus contains but one species, which until recently was included in *Anthomyia*. The distinguishing characters are as follows: Calyptra unequal in size, the lower one protruding beyond the upper; arista almost bare; hypopleura with long hairs above in front of spiracle; propleura bare cephalad and ventrad of spiracle; sixth wing-vein complete.

The genotype recorded below is found throughout Europe and North America.

**Calythea albicincta** Fallen

1820. *Musca al'icincta* Fallen, Faun. Suec., Musc., 73.

Six males and six females, Alamogordo, New Mexico, April 9 to May 15, 1902; one female, Highrolls, New Mexico, May 31, 1902; one female, Mesa Grande, Sonoma County, California, May, 1908 (J. P. Baumberger); one female, Clouderoft, New Mexico, May 16, 1902; one female, Moscow, Idaho, June 2, 1908.

**EGLE** R.-D.

This genus contains several species that have been placed in *Anthomyia* and one that has been placed in *Phorbia* (*Hylemyia*) by American authors. Two species in this collection are referable here, one of which is evidently undescribed.

**Egle cinerella** Fallen

1820. *Musca cinerella* Fallen, Dipt. Suec., Musc., 77.

Eight specimens with data as follows: two males, one female, Berkeley Hills, Alameda County, California, April, 1908; three males, Mesa Grande, Sonoma County, California, June, 1908; one female, same locality, May, 1908; one female, same locality, July 12, 1908.

**Egle hirta** sp. n.

*Male.*—Deep black, slightly shining. Head black, interfrontalia, facalia, and cheeks largely reddish testaceous; antennae and palpi black. Thorax with a narrow vitta between acrostichals and dorso-centrals, a spot mesad of humerus, and the lateral margins gray pruinose. Abdomen with a large, oblong, gray pruinose patch on each side of each dorsal segment, leaving the anterior and posterior margins and center of the segments deep black. Legs black. Wings clear, veins black. Calyptra white. Halteres yellow.

Eyes separated by width of anterior ocellus; parafacials in profile much wider than third antennal joint and slightly wider than height of cheek, the latter densely haired posteriorly on lower margin and with a clump of

strongly curved hairs invading the cheek caudad of the vibrissal angle; vibrissa not stronger than the other eight to nine hairs in the series with it; antennae shorter than face, third joint one and one-half times as long as second, arista almost bare; face concave in profile, mouth margin protruded further than frons at base of antennae. Thorax with long erect hairs, the bristles longer than the hairs, but not very strong; presutural acrostichals represented by about six series of slender erect hairs; postsutural dorso-centrals three; prealar weak; sternopleura and mesopleura posteriorly and the area just above fore coxa with dense long hairs, the sternopleural bristles hardly distinguishable. Abdomen subovate, with dense, erect long hair laterally. Legs normal; fore tibia with one antero-dorsal and one posterior bristle; mid femur with very short setulose hairs on basal half of antero-ventral surface, and seven to nine long, slender bristles on basal half; mid tibia with one antero-ventral, one antero-dorsal, three postero-dorsal, and two postero-ventral bristles; hind femur with a continuous series of very long bristles on antero-ventral surface, and another series of shorter bristles on postero-ventral surface which become very short near apex; hind tibia with one short antero-ventral bristle, a series of rather closely placed short setulose hairs (13 to 15) extending from base to near apex on antero-dorsal surface, and three long bristles on postero-dorsal surface. Apical sections of veins 3 and 4 decidedly convergent at apices; outer cross-vein oblique, not very much curved; costal thorn minute. Length, 5.5 mm.

*Type.*—♂; Beulah, New Mexico, June 28, 1902, top of range, [A. N. S. No. 6210].

This species closely resembles *mystacea* Coquillett, but differs in having an antero-ventral mid tibial bristle, the short bristles on antero-dorsal surface of hind tibia more numerous, and only three bristles on postero-dorsal surface of that tibia.

### PEGOMYIA R.-D.

I have placed in this genus five species in this collection, two of which are new. The last three species are placed here provisionally.

The lower calypter is protruded distinctly beyond upper in both species. This character alone is not sufficient for generic separation, but, until I am in a position to publish reliable distinguishing characters for this and allied genera, the present arrangement is the best available.

**Pegomyia hyoscyami** Panzer

1809. *Musca hyoscyami* Panzer, Faun. Germ., cviii, 13.

One female specimen of this species from Beulah, New Mexico, June 28, 1902, top of range.

A very common species in Europe and North America. The larvae mine in leaves of spinach, beet, lambs-quarters, etc.

**Pegomyia acutipennis** sp. n.

*Male.*—Black, densely gray pruinose, thorax slightly shining. Head black; frontal triangle and parafacials largely rufous. Antennae and palpi black. Thorax with three rather indistinct brownish black vittae, the laterals most distinct caudad of suture. Abdomen marked as in *Anthomyia pluvialis* Linné. Legs black, mid and hind femora brownish towards apices, all tibia reddish testaceous. Wings clear. Calyptra white. Halteres yellowish.

Eyes very large, covering almost the entire side of head, almost touching above, parafacials linear in profile, cheek not higher than width of third antennal joint, the latter less than twice as long as second; arista microscopically pubescent. Thorax with three pairs of presutural acrostichals; prealar bristle about one-third as long as the bristle behind it. Abdomen flattened; fifth sternite with a deep central incision, each lateral process terminating in a rounded point, the margin of the incision armed with rather dense, short stiff hairs; hypopygium small. Fore tibia with two short bristles, one antero-dorsal and one posterior; mid femur with five to seven bristles on basal half of postero-ventral surface; mid tibia with one antero-dorsal, one to two postero-dorsal, and one to three posterior bristles; hind femur with a series of bristles on antero-ventral surface from base to apex, and another on postero-ventral surface from base to beyond middle; hind tibia with two short antero-ventral setulae, two longer antero-dorsal bristles, and two postero-dorsal bristles, the lower one very long. Wings slightly pointed, third vein ending almost in apex; costal thorn very weak.

*Female.*—Differs from the male in having the anterior half of interfrontalia orange red, and the legs much paler, the femora being entirely reddish testaceous or with a slight darkening on the fore pair.

Eyes separated by about one-third the head-width; orbits about one-third as wide as interfrontalia, the bristles rather short, lower supraorbital directed forward; cruciate bristles present; cheek not higher than width of third antennal joint; palpi very broad, spatulate; mid and hind femora with fewer and much shorter bristles than in male. Wing less pointed than in male. Length, 4.5 to 5.5 mm.

*Type.*—♂; Alamogordo, New Mexico, April 30, 1902, [A. N. S. No. 6211]. *Paratypes.*—2 ♂, topotypical, April 30 and May 2, 1902; 1 ♀, Cloudcroft, New Mexico, May 16, 1902; 1 ♀, Carr Cañon, Huachuca Mountains, Cochise County, Arizona, August, 1905.

This species resembles *Anthomyia pluvialis* Linné in markings of the abdomen, but does not belong to the same genus, having the propleura bare ventrad of humerus.

**Pegomyia affinis** Stein

1897. *Pegomyia affinis* Stein, Berl. Ent. Zeit., xliii, 286.

This species is usually found in caves or in holes in the ground frequented by mammals. In the collection there are six males and three females with the following data: Grizzly Peak, Berkeley Hills, California, March 24, 1908; Berkeley Hills, April 11, 1908; November 19, 1908, (? C. Fuchs); Alamogordo, New Mexico, April 30 and May 8, 1902.

This species is the only one in the subfamily known to me that has bristles at base of the third vein. These bristles are very weak, and sometimes absent.

**Pegomyia minuta** sp. n.

*Male.*—Head yellowish testaceous; occiput gray, densely gray pruinose; face and facial orbits densely white pruinose, most noticeable when seen from in front; third antennal joint entirely black; arista black at base; palpi yellow. Thorax fuscous or brownish, densely gray pruinose, not vittate. Abdomen clay colored, apices of segments paler, each dorsal segment with a dark spot at base in center which does not extend to apex of segment; the hairs and bristles each with base surrounded by a black or brown dot; fifth sternite yellowish. Legs yellowish testaceous, the femora brownish on middle. Wings clear. Calyptra and halteres whitish.

Head large, in profile with frons slightly protuberant anteriorly; eyes separated by width across posterior ocelli; orbital bristles not carried to ocellar triangle; antennae not reaching beyond two-thirds of distance to mouth margin; third joint slender, not twice as long as second; arista nearly bare, third joint distinctly swollen at base for about twice the length of second joint; parafacial in profile nearly as wide as third antennal joint and half as wide as height of cheek, the latter about one-fourth as high as eye, with a single series of weak, black marginal bristles. Presutural acrostichals short and stout, four to five pairs; prealar bristle absent. Abdomen narrow, slightly depressed; processes of fifth sternite narrow, glossy, their apices rounded, surfaces with weak hairs except on apical third. Fore tibia with one weak posterior setula; mid tibia with one postero-dorsal and two posterior short bristles; antero-ventral surface of hind femur with a few widely placed short bristles; hind tibia with one antero-ventral, three antero-dorsal, and two postero-dorsal bristles. Costal thorn very minute; outer cross-vein almost straight; third vein ending in wing tip. Length, 4 mm.

*Type.*—♂; Alamogordo, New Mexico, April 14, 1902, [A. N. S. No. 6212].

This species is closely allied in *ruficeps* Stein and *rufescens* Stein. From both of these species it may be separated by the entirely black third antennal joint and the shape of the processes of the fifth abdominal sternite.

**Pegomyia** sp.?

There is a female in rather poor condition in the collection which closely resembles the preceding species. It agrees with *minuta* in color. The cruciate frontal bristles are absent, the tibial bristles are stronger, there is one on antero-dorsal surface of mid tibia and two on antero-dorsal surface of hind tibia.

Locality; Milbrae, San Mateo County, California, March 20, 1908.

**Pegomyia bicolor** Wied

1817. *Anthomyia bicolor* Wiedemann, Zool. Mag., i, 77.

Three females of this European species from California; two, Berkeley Hills, Alameda County, California, April 20, 1908; one, Redwood Cañon, Marin County, May 17, 1908.

The larvae feed in leaves of dock. The species has previously been reported from North America.

## HAMMOMYIA R.-D.

There are several species of this genus in North America, only one of which is in this collection.

**Hammomyia maculata** Stein

1897. *Hammomyia maculata* Stein, Berl. Ent. Zeit., xlii, 228.

This species appears to be western in its distribution. I have seen it from Montana and Idaho. There are two specimens before me as follows: one male, Beulah, New Mexico, August 17 (H. Skinner), and one female, Clouderoft, New Mexico, May 24, 1902.

## EREMOMYIA Stein

This genus is represented by two species in this collection.

**Eremomyia apicalis** Stein

1897. *Eremomyia apicalis* Stein, Berl. Ent. Zeit., xlii, 227.

The female of this species has not been described.

Compared with the male type, which is now before me, it differs in being much larger, ten millimeters in length, and more robust, the eyes are separated at vertex by a little more than one-third the head-width, the third antennal joint is slightly broader than the parafacial in profile, the palpi are slightly broadened and extend almost to apex of proboscis, the abdomen lacks the dorsal stripe, and the last section of fourth vein is as long as preceding section.

Locality; Cloudcroft, New Mexico, May 24, 1902.

There is one long hair on lower portion of each petropleura in this specimen, which is not present in the male nor in *humeralis* Stein.

**Eremomyia depressa** sp. n.

*Male.*—Black, slightly shining. Interfrontalia, face, and cheeks brownish, the orbits, face, and cheeks with white, almost silvery pruinescence; antennae and palpi entirely black. Dorsum of thorax with distinct whitish pruinescence, the disc when seen from behind with five black vittae, the median three narrow, the sublaterals broad. Abdomen with distinct grayish pruinescence on dorsum, and with a dorso-central black vitta which tapers slightly from base to apex. Legs black. Wings clear, veins black. Calyptra white. Halteres yellow.

Width of frons at narrowest point about equal to width across posterior ocelli; face buccate in profile; width of parafacials in profile distinctly greater at base of antennae than width of third antennal joint; becoming narrower below; cheek about twice as high as width of parafacial, the lower margin with four to five series of bristly hairs which become upwardly curved anteriorly and do not extend to vibrissal angle; vibrissa distinct, not very strong, with a number of bristly hairs at base and above it on facial ridge. Antennae shorter than face, third joint narrow, about one and one-half times as long as second, the latter with short dense hairs and three long slender bristles; arista distinctly swollen at base, densely pubescent. Thoracic dorsum with rather sparse, erect, moderately long hairs between the long, strong bristles; one pair of very long presutural acrostichals and three to four much weaker; posthumeral bristle duplicated and with a third, very long, hair lateral of it; prealar bristle about two-thirds as long as bristle behind it; pleura normal. Abdomen ovate, depressed; hypopygium small. Fore tibia with two posterior bristles; mid femur with one to two strong bristles on basal half of antero-ventral surface and four to five on basal half of postero-ventral; mid tibia with one antero-dorsal, one postero-ventral, and two postero-dorsal bristles, the lower one of the last two and both the others at nearly the same length from apex; hind femur with a series of rather widely placed strong bristles on whole length of antero-ventral surface, the postero-ventral surface with moderately long hairs, and two strong bristles at middle; hind tibia with six to eight antero-ventral, four to six antero-dorsal, and three to four postero-dorsal bristles, the posterior surface with four to seven slender bristles on basal half. Costal thorn indistinguishable, the costa with very short, dense, setulose hairs; veins 3 and 4 very decidedly convergent apically; outer cross-vein almost parallel to wing margin, very much curved. Lower calypter almost as large as upper. Length, 6.75 mm.

*Type.*—♂; Troy, Idaho, May 31, 1908, [A. N. S. No. 6213].

This species differs from any in this genus known to me in having the abdomen depressed, the cheeks with very conspicuous

hairs, which are not confined to margin but invade the cheek itself, and the bristles adjoining the vibrissa hair-like and not very numerous.

It is probable that this species will require to be placed in a new genus, but comparison of both sexes of the species involved is necessary to permit of a decision on this point, and only the male of *depressa* is available to me at this time.

### HYLEMYIA R.-D.

I have dropped the very unsatisfactory genus *Phorbia* in this paper, because no separation of genera can be based upon the very unstable character of the hairing of the arista. If we accept the presence or absence of hairs on the arista as the distinguishing character for these and other anthomyiid genera, we undoubtedly obtain results which are neither satisfactory nor in agreement with natural relationships.

All the species I have described in this and other papers, and those already described or recorded by Stein from North America, have been incorporated in a key which I have in manuscript and hope to publish when I complete working over the material now on hand.

**Hylemyia antiqua** Meigen

1826. *Anthomyia antiqua* Meigen, Sys. Beschr., v, 166.

There are four females in the collection which agree with specimens of this common, widely distributed species before me which were bred from onions near Chicago, Illinois.

Locality; San Francisco, California, (F. E. Blaisdell), one specimen, May 27, 1908, three specimens, August 7, 1908.

**Hylemyia fracta** sp. n.

*Male.*—Black, slightly shining. Head black, interfrontalia, anterior half of parafacials, and the upper anterior portion of cheeks rufous; face, cheeks, and orbits with white pruinescence; antennae and palpi black. Thoracic dorsum with slight whitish pruinescence, which is most distinct on lateral margins, and between the acrostichals and dorso-centrals anteriorly; pleura whitish pruinose. Abdomen rather densely whitish pruinescent, less pronouncedly so on posterior margin, each segment with a central black stripe, and the anterior margin black. Legs black. Wings clear, veins black. Calyptra white, margins yellowish. Halteres yellow.

Eyes separated by a little more than width of anterior ocellus; antennae distinctly shorter than face, third joint one and one-half times as long as second; arista with microscopic pubescence; parafacial in profile broader than

width of third antennal joint at base of antennae, becoming narrower below, cheek nearly twice as high as width of parafacial, margin with two to three series of long bristly hairs, which are upwardly curved on the greater portion of the series, vibrissal angle very slight, three to four bristles above vibrissa. Thorax with long hairs and bristles, the former not dense; three pairs of long presutural acrostichals; postsutural dorso-centrals three; prealar bristle a little over one-third as long as the bristle behind it; sternopleurals one: two. Abdomen rather strongly bristled; fifth sternite with slender processes, which are armed with a few moderately long bristly hairs on their discs. Fore tibia with one long posterior median bristle, the apex on posterior side with a long, strong downwardly directed, slightly forward, or upward curved bristle which is blunt at its apex as if broken off; mid femur with seven to nine closely placed, long, slender bristles on basal half of postero-ventral surface; mid tibia with five weak bristles, one antero-dorsal, two postero-dorsal, and two postero-ventral; mid tarsus less than two-thirds as long as mid tibia; hind femur with four to six bristles on apical half of antero-ventral surface, the postero-ventral surface unarmed; hind tibia with four to five short antero-ventral bristles, four to five slightly longer antero-dorsal bristles, interspersed on basal half with some setulose hairs, and three long postero-dorsal bristles, posterior surface with four to five setulose hairs on basal half; hind tarsus almost as long as hind tibia. Costal vein very thin to near apex of first vein; costal thorn very small; outer cross-vein oblique, slightly curved. Length, 6 mm.

*Type.*—♂; Cloudcroft, New Mexico, May 26, 1902, [A. N. S. No. 6221].

This species runs down to *antiqua* Meigen in an unpublished key of mine, resembling that species in having a blunt spine at apex of fore tibia on posterior side and entirely black legs, but is readily separated by the more hairy cheeks, much longer and more widely spaced presutural acrostichals, longer prealar bristle, shorter mid tarsus, and the tibial chaetotaxy.

**Hylemyia facialis** sp. n.

*Male.*—Black, slightly shining, densely gray pruinescent. Head black; orbits, face, and cheeks with dense white pruinescence, when seen from the side the orbit has an opaque testaceous yellow spot at base of antennae which becomes black below, and a blackish brown spot at lower angle of eye, which adjoins a yellowish mark on vibrissal angle of cheek; second antennal joint rufous; palpi fuscous. Thoracic dorsum with three narrow brown vittae. Abdomen with a median black spot on base of each segment on dorsum; processes of fifth sternite largely testaceous. Legs yellowish testaceous, coxae grayish; tarsi fuscous. Wings clear; junction of second and third veins, and both cross-veins conspicuously brownish. Calyptra white. Halteres yellow.

Eyes separated by width of anterior ocellus; orbital bristles on lower half

only; antennae reaching almost to mouth margin, third joint twice as long as second; arista with the longest hairs slightly shorter than width of third antennal joint; parafacials in profile slightly less than width of third antennal joint and less than half as wide as height of cheek, the latter with one to two series of marginal bristles; vibrissa above lower level of cheek. Thorax with three to four pairs of widely separated presutural acrostichals, between which there are no weak hairs; prealar bristle over one-third as long as the bristle behind it. Abdomen slightly flattened; fifth sternite with a pair of short, broad, apically truncated processes, the lower margins of which are armed with very closely placed, fine, short hairs, the apex less densely fringed; hypopygium rather large for a species of this genus, the sixth abdominal segment glossy black, contrasting sharply with the basal segment of hypopygium, both of them with long, strong bristles. Legs stout; fore tibia with one antero-dorsal and one postero-ventral bristle; mid femur with two to three short, weak bristles near base of postero-ventral surface; mid tibia with one antero-dorsal, two postero-dorsal, and two postero-ventral bristles; mid tarsus distinctly shorter than mid tibia; mid femur with four to six strong bristles on antero-ventral surface, the longest and strongest one near middle, the postero-ventral surface with one to two short, stout bristles near middle; hind tibia with two short antero-ventral, four unequal antero-dorsal, and three strong postero-dorsal bristles, posterior surface with an irregular series of six to nine short, erect, setulose hairs on basal half; hind tarsus very little shorter than hind tibia. Costal thorn very short; apex of wing rather acute, third vein ending almost in tip, fourth vein ending almost as far behind tip as second does in front of it. Length, 6 mm.

*Type*.—♂; Yosemite Valley, California, May 22, 1908. [A. N. S. 6214].

This species differs from others with pale legs known to me in having three infuscated areas on wings, in structure of the fifth abdominal sternite, and in chaetotaxy of the legs.

**Hylemyia alcathoë** Walker

1849. *Anthomyia alcathoë* Walker, List, iv, 937.

There are nineteen specimens of this species in the collection as follows: two males, Redwood Cañon, Marin County, California, May 17, 1908; three males, Lagunitas Cañon, Marin County, California, March 29, 1908; two males and two females, Yosemite Valley, California, May 22, 1908; four males, Berkeley Hills, California, March 22, 1908; two females, same locality, April 20, 1908; two females, Mesa Grande, Sonoma County, California, May, 1908, (J. P. Baumberger); one female, same locality, June, 1908; one male, San Francisco, California, March 30, 1908, (F. E. Blaisdell).

**Hylemyia duplicata** sp. n.

*Male.*—Black, densely gray pruinescent. Orbits, face and cheeks with silvery pruinescence; frontal triangle rufous; antennae black, second joint brownish at apex; palpi black. Thoracic dorsum with three fuscous vittae. Abdomen with a fuscous dorso-central stripe. Legs ferruginous, coxae and a longitudinal stripe on postero-dorsal surface of fore femora fuscous. Calyptra white. Halteres whitish yellow. Wings clear, veins brown, cross-veins very faintly infuscated.

Eyes in type separated by distinctly less than width across posterior ocelli; orbits contiguous, obliterating interfrontalia for a considerable distance below ocelli; arista microscopically pubescent; parafacials as broad in profile as third antennal joint; height of cheek one-sixth that of eye; bristles on frons not carried beyond middle. Thorax with three strong pairs of presutural acrostichals; sternopleura with four bristles. Abdomen cylindrical; the forwardly directed apical processes of hypopygium slender, armed along their lower surfaces (when directed forward) with dense, very short, black bristly hairs (fig. 4); fore tibia with one antero-dorsal bristle, and one posterior; mid femur with two to three strong bristles on basal half of postero-ventral surface; mid tibia with one antero-dorsal, one postero-dorsal, and two posterior bristles; hind femur with a complete series of strong, rather widely spaced bristles on antero-ventral surface and two to three on postero-ventral at middle; hind tibia with one antero-ventral, two antero-dorsal, and two postero-dorsal bristles. Costal thorn shorter than inner cross-vein; outer cross-vein very oblique, distinctly bent.

*Female.*—Similar to the male in color, the anterior half of interfrontalia red. Eyes separated by at least one-third the head-width at vertex, wider anteriorly; cruciate bristles absent. Fore tarsi normal. Length, 7 to 8.5 mm.

*Type.*—♂; Yosemite Valley, California, May 22, 1908, [A. N. S. No. 6215]. *Paratypes.*—3 ♂, 1 ♀, topotypical; 2 ♂, Redwood Cañon, Marin County, California, May 17, 1908; 1 ♂, 2 ♀, Berkeley Hills, California, April 20, 1908; 1 ♂, same locality, March 14, 1908; 1 ♂, Grizzly Peak, Berkeley Hills, California, March 23, 1908; 1 ♂, Cloudcroft, New Mexico, June 19, 1902; 1 ♂, Beulah, New Mexico, June 28, 1902; 1 ♂, Troy, Idaho, May 31, 1908.

The series shows a considerable variation in size and color, the antennae being sometimes almost entirely black, and sometimes with the second and base of third joint rufous, while the palpi are black with pale bases or almost entirely pale. Two of the specimens from the type locality have the eyes closer together than the others and are in other respects slightly different, but the hypopygia of the males present no tangible distinctions and I consider them as merely variants. The mid tibia has sometimes a weak antero-ventral bristle.

**Hylemyia substriatella** sp. n.

*Male.*—Similar to the preceding species in color. The type specimen has the second antennal joint rufous and the palpi black. The cross-veins are very slightly clouded.

Structurally the species are similar but the mid tibiae have an antero-ventral bristle which is much stronger than that of the preceding species; the hind tibia has two antero-ventrals, and the hypopygium differs as shown in figure 3. Length, 8.75 mm.

*Type.*—♂; Falls Church, Virginia, October, [Coll. Illinois].

This species is added to facilitate comparison.

**Hylemyia sp.?**

Three female specimens of a species somewhat resembling *duplicata*, but differing in having the arista short-haired, the femora browned at middle, the outer cross-vein straight and almost erect, and the tibiae with more numerous bristles. The clouded cross-veins of this species separate it from most species of this genus.

Localities: Clouderoft, New Mexico, June 16, 1902; Alamogordo, New Mexico, May 5, 1902.

**Hylemyia variata** Fln.

1820. *Musca variata* Fallen, Dipt. Suec., Muse., 59.

This species occurs throughout Europe and North America, even as far north as Alaska.

Represented in this collection by two males from Berkeley Hills, Alameda County, California, April 11 and 20, 1908; one female, Redwood Cañon, Marin County, California, May 17, 1908, and one male, Troy, Idaho, May 31, 1908.

**Hylemyia brevitarsis** sp. n.

*Male.*—Black, shining; thorax rather indistinctly trivittate; abdomen with a broad black dorso-central stripe and poorly defined black posterior and anterior margins to segments. Calyptra white. Halteres yellow.

Eyes separated by more than width across posterior ocelli; parafacial in profile wider than width of third antennal joint; the latter less than twice as long as second; arista bare; cheek one-third as high as eye and higher than width of parafacial; proboscis rather slender. Thorax with long, but not dense hairs; three pairs of long presutural acrostichals present; prealar about half as long as the bristle behind it. Abdomen narrow, parallel-sided; fifth sternite shining, the processes broad, rounded at apices, almost bare on lower half, and with many long bristles on upper half. Mid femur with short bristly hairs on antero-ventral surface, those on postero-ventral very long and strong; hind

femur with long bristles on antero- and postero-ventral surfaces, those on the former more closely placed and much the strongest; fore and mid tibiae with or without a weak posterior bristle; hind tibia usually with three antero-dorsal and three postero-dorsal bristles, the lowest pair not much below middle; antero-ventral surface sometimes with one to two weak setulae; tarsi on all legs distinctly shorter than tibiae, the posterior surfaces of mid and hind pairs with short subercct setulose hairs. Costal thorn weak; outer cross-vein straight; apex of wing rather pointed, third vein ending almost exactly in tip. Length, 7 mm.

*Type.*—♂; Redwood Cañon, Marin County, California, May 17, 1908, [A. N. S. No. 6216]. *Paratypes.*—2 specimens; Lagunitas Cañon, Marin County, California, March 29, 1908.

This species bears a strong resemblance to *spiniventris* Coquillett, but the fifth sternite and chaetotaxy of the legs separate it from that species and its allies.

**Hylemyia neomexicana** sp. n.

*Male.*—Black, subopaque, densely gray pruinescent. Head black, frontal triangle, face, greater portion of parafacials, and cheeks rufous; antennae, proboscis, and palpi black. Thorax without vittae. Abdomen with a moderately broad, black dorso-central vitta. Legs black, tibiae pale, reddish, but the specimen is slightly teneral and in mature examples the legs may be entirely black. Wings clear. Calyptra white. Halteres pale.

Eyes separated by about width of anterior ocellus; parafacials in profile about as wide as third antennal joint; cheek nearly twice as high as width of parafacial, marginal bristles long but not strong, in a single series, three to four on anterior half upwardly directed, vibrissa long; arista with the longest hairs about equal in length to basal diameter of arista. Presutural acrostichals long but irregular, two distinct pairs in type; prealar bristle minute or absent. Abdomen depressed, parallel-sided; hypopygium small; fifth sternite deeply cleft, the lateral processes not very long, armed with dense, short, erect bristly hairs on inner sides and with some discal bristles which become longer at apex. Fore tibia with one posterior bristle at middle; mid femur with a series of long bristles on basal half of postero-ventral surface; mid tibia with one antero-dorsal, two postero-dorsal, and two postero-ventral bristles; hind femur with a complete series of bristles on both antero- and postero-ventral surfaces, the former much stronger and longer than the latter; hind tibia with three postero-dorsal bristles, and long erect setulose hairs on all the other surfaces, the longest of which is almost twice as long as diameter of tibia; all tarsi slightly compressed, with the normal armature, the hind pair as long as tibiae. Costal thorn short; veins 3 and 4 subparallel apically. Length, 5 mm.

*Type.*—♂; top of Las Vegas Range, above Beulah, New Mexico, June 28, 1902, [A. N. S. No. 6217].

This species is allied to *Hylemyia* (*Phorbia*) *fusciceps* Zetterstedt, but differs in having more than one series of erect hairs on the hind tibia. There is another western species which is very closely related to *neomexicana*, the differentiating characters being enumerated below.

**Hylemyia cilifera** sp. n.

*Male.*—Differs from the preceding species in color in having the head black.

The prealar bristle is nearly half as long as the one behind it; the fifth abdominal sternite is almost bare along the inner margins of the processes, but the discs of these are furnished with much longer and stronger bristles than in *neomexicana;* the armature of the legs is stronger than in that species and very nearly the same, the noticeable difference being that in *neomexicana* the antero-ventral series of erect hairs on hind tibia is nearly uniform in spacing and strength from base to near apex, whereas in *cilifera* the hairs become more widely spaced and distinctly stronger beyond middle, the last one being bristle-like and rather widely removed from the one basad of it. Length, 6.5 mm.

*Type.*—♂; Gallatin County, Montana, June 13, 1917, [Illinois].

**Hylemyia spiniventris** Coquillett

1900. *Hylemyia spiniventris* Coquillett, Pro. Wash. Ac. Sci., ii, 449.

This species is represented by five males and nine females in this collection, all of which were taken at Beulah, New Mexico, June 28, 1902, on top of the range.

This species and the four following agree very closely in color, *spiniventris* differing noticeably in having the wings largely fuscous. The mid and hind femora are armed on the antero- and postero-ventral surfaces with strong bristles which are present on at least the basal half, and the hind tibiae are armed with very long bristles.

**Hylemyia marginella** sp. n.

*Male.*—Black, slightly shining. Frons, orbits, face, and cheeks with whitish pruinescence. Thorax indistinctly trivittate, the spaces between vittae whitish pruinescent. Abdomen with a broad black dorso-central stripe, which is dilated anteriorly on each segment. Wings almost hyaline, fuscous at base. Legs black. Calyptra white. Halteres yellow.

Eyes separated by at least the width across posterior ocelli; head in profile the same as in *marginata* Stein; arista with the longest hairs not much more than as long as basal diameter of arista; parafacials in profile distinctly wider than third antennal joint and slightly over half as wide as height of cheek.

Presutural acrostichals irregularly four-rowed, weak, of moderate length, the outer two rows longest; prealar nearly as long as the bristle behind it. Abdomen about twice as long as wide, parallel-sided; fifth sternite with weaker but more numerous discal bristles than in *marginata*, the inner margin of each process with minute spinules which are very noticeably shorter than those of *marginata* (figs. 5 and 8); hypopigium differing from that of *marginata* in having the dorsal processes stout and blunt at apex (figs 10 and 11). Chaetotaxy of legs as in *marginata* but the bristles are longer and stronger.

*Female.*—Differs in color from the male in having the body less shining and not so deep black, owing to the presence of brownish yellow pruinescence. The head is entirely black, with the interfrontalia opaque, almost velvety black. The thorax and abdomen are less distinctly vittate than in the male, and the wings are paler at base.

Structurally and in chaetotaxy the species closely resembles *spiniventris* Coquillett and *marginata* Stein but the arista is much shorter haired than in either of these species. Length, 6.75 mm.

*Type.*—♂; Tennessee Pass, Colorado, July 24, 1917, (Aldrich), [Coll. Illinois]. *Paratypes.*—4 ♂, 6 ♀, Beulah, New Mexico, June 28, 1902, top of range.

A female from Redwood Cañon, Marin County, California, May 17, 1908, may be this species.

**Hylemyia spinilamellata** sp. n.

*Male.*—Similar to the last species in color.

Structurally similar to the preceding species, but differing from it in that the longest hairs on the arista are as long as the width of the third antennal joint, the eyes are a little closer together, the presutural acrostichals cover a narrower strip, the processes of fifth abdominal sternite are armed with longer stout spines on basal half of inner margin (fig. 7), and the hypopygium is entirely different (fig. 9).

*Female.*—Similar to the female of the preceding species, but having the arista with much longer hairs. Length, 6 to 7 mm.

*Type.*—♂; Silver Lake, Utah, July 10, [Coll. Illinois]. *Paratypes.*—2 ♀, Beulah, New Mexico, June 28, 1902, top of range.

This species is more closely allied to *marginata* Stein than to *marginella*, but the hypopygium is entirely different from that of *marginata* as shown in figures. The male has very short, regular bristles on antero-ventral surface of mid femora, which become shorter towards apex, whereas in the other species the bristles are very long and generally confined to basal half. The costal thorn is absent in type.

**Hylemyia piloseta** sp. n.

*Male.*—Agrees in color with *marginella*.

Eyes separated by distinctly more than the width across posterior ocelli; arista with the longest hairs not as long as basal diameter of arista; parafacial in profile almost as wide as height of cheek. The armature of fifth abdominal sternite is similar to that of *marginata* and *spinilamellata* (fig. 6), but the hypopygium is distinctly different (fig. 12). The chaetotaxy of the legs is similar to that of the other members of this group, but the femoral bristles of mid and hind legs are longer and stronger on the ventral surface and form more nearly complete series than in the others. The outer cross-vein is more erect and much straighter than in any of the other species, especially *marginata*. Length, 7 mm.

*Type.*—♂; Corvallis, Oregon, April 26, 1908, [Coll. Illinois]. *Paratypes.*—1 ♂, Mary's River, Oregon, [Coll. Illinois]; Troy, Idaho, May 31, 1908.

Type and one paratype in the collection of Illinois State Natural History Survey, one paratype in the Academy of Natural Sciences of Philadelphia.

There are several more species closely allied to the foregoing in North America, some of which I have before me now. The species described by Johannsen as *Hammomyia setigera* is a *Hylemyia* very closely related to, if not identical with, *marginata* Stein. I have not seen *setigera*, but the description agrees more closely with *marginata* than with any species known to me and the hypopygia are very much alike.

**Hylemyia mimetica** sp. n.

*Male.*—Black, shining. Face, orbits, and cheeks with slight whitish pruinescence. Thoracic dorsum indistinctly trivittate. Abdomen with the dorsum very conspicuously brownish gray pruinescent, when viewed from behind with a broad black central line, when viewed from above and laterally the segments appear to be blackened on anterior and posterior margins; hypopygium glossy black. Legs black. Wings subfuscous. Calyptra white. Halteres yellow.

Eyes separated by a little more than width of anterior ocellus; parafacial in profile nearly as wide as third antennal joint at base of antennae, becoming much narrower below; cheek about one-fifth as high as eye; arista with the longest hairs slightly longer than its basal diameter. Thorax with three pairs of moderately strong presutural acrostichals, between which there are no weak hairs. Abdomen narrow, slightly tapered to apex, depressed; hypopygium small; fifth sternite with two narrow elongate processes, which are armed with soft erect hairs along their inner margins and to middle of disc, the hairs longer at bases of processes, but nowhere bristly. Fore tibia with

one weak antero-dorsal, and two stronger postero-ventral bristles; fore tarsus very slightly compressed, longer than tibia; mid femur with irregular bristles and hairs on antero- and postero-ventral surfaces, longest on basal half and especially on that of postero-ventral surface; mid tibia with one antero-dorsal, two postero-dorsal, and three to four posterior bristles, the latter in an irregular series; mid tarsus shorter than mid tibia; hind femur with a series of strong, rather irregular bristles on antero- and postero-ventral surfaces, those of the latter not continued to apex; hind tibia with five to seven uneven antero-dorsal, and three to four postero-dorsal bristles, the posterior surface with about nine strong, suberect, setulose hairs; tarsus shorter than tibia. Costal thorn short; outer cross-vein oblique, distinctly curved. Length, 4.75 mm.

*Type.*—♂; Cloudcroft, New Mexico, May 27, 1902, [A. N. S. No. 6218].

This species closely resembles one which I have described in a paper now in the press, from Alaska, but the latter differs in having one posterior hind tibial bristle, the wings yellowish, and in some minor details. Another closely allied species is described herewith.

**Hylemyia anthracina** sp. n.

*Male.*—Similar in color to the preceding species, the thorax and abdomen more distinctly vittate, and the wings clearer.

Eyes separated by width across posterior ocelli; parafacials in profile broader than in *mimetica*, their width exceeding that of third antennal joint and nearly equal to that of cheek; arista pubescent, the longest hairs not as long as basal diameter of arista. Presutural acrostichals rather irregular, three to four pairs; prealar bristle more than half as long as the bristle behind it. Abdomen as in *mimetica*, but the fifth sternite with longer strong bristles especially at apices of processes, where in the type they are cruciate. Fore tibia with two posterior bristles; mid femur with a series of five to seven bristles to beyond middle of postero-ventral surface; armature of hind femur as in preceding species, that of hind tibia differing essentially in having five to seven very short posterior setulae on median third, none of which are longer than the diameter of tibia, whereas in *mimetica* the bristles are longer than the tibial diameter and extend from base to near apex. Venation as in *mimetica*, but the outer cross-vein is straight. Length, 5.25 mm.

*Type.*—♂; Hood River, Oregon, June 21, 1917, [Coll. Illinois].

This species is inserted here because of the close resemblance to *mimetica*, and its western origin.

**Hylemyia** sp.?

One male in collection differs from any North American species known to me in having the acrostichals in front of suture nearly

in a single irregular series. It most closely resembles *anthracina* of those described in this paper, but the eyes are closer together, the arista has longer hairs, the prealar is very short, the hind tibial armature is different, and the wing veins are yellow.

Locality; Beulah, New Mexico, June 29, 1902.

**Hylemyia angustiventris** sp. n.

*Male.*—Black, slightly shining, densely gray pruinescent. Head black, interfrontalia, parafacials, and greater portion of cheeks reddish testaceous. Thoracic dorsum with three faintly indicated vittae, the median one most distinct, lateral margins more distinctly pruinose than disc. Abdomen with a shining, fuscous dorso-central vitta, which is of uniform width from base to apex. Legs brownish black, the hind tibiae paler. Wings clear. Calyptra white. Halteres yellow.

Eyes separated by not more than width of anterior ocellus; face concave in profile, the parafacial much narrowed at lower angle of eye; antennae almost as long as face, third joint less than one and one-half times as long as second; arista hairy, the longest hairs a little longer than basal diameter of arista; cheek about one-fifth as high as eye, anterior angle distinctly but not greatly produced, margin with short hairs and a few longer bristles, some of those near anterior margin upwardly curved; vibrissa long, a few weak hairs above it; proboscis stout. Presutural acrostichals weak, one to two pairs in irregular order; prealar bristle absent, only the usual bristles above fore coxae, and those weak. Abdomen narrow, about three times as long as wide, fourth (visible) segment longest; fourth sternite with three to five long downwardly directed bristly hairs on each lateral margin; fifth sternite without abnormal bristling. Fore tibia with two bristles, one antero-dorsal, and one postero-ventral; fore tarsus longer than fore tibia, but little compressed; mid femur with four to six bristles on basal half of postero-ventral surface; mid tibia with one anterior, one postero-dorsal, and two postero-ventral bristles; hind femur with four to five weak bristles on apical half of antero-ventral surface, the postero-ventral surface unarmed; hind tibia with two antero-ventral, four to six antero-dorsal, and three stronger postero-dorsal bristles, the posterior surface with a few setulose hairs on basal half. Veins 3 and 4 convergent at apices; outer cross-veins straight; costal thorn minute. Length, 4 mm.

*Type.*—♂; Clouderoft, New Mexico, June 18, 1902, [A. N. S. No. 6219]. *Paratypes.*—1 ♂, topotypical, June 16.

This species resembles *linearis* Stein, but the latter has the eyes separated by nearly the width across the posterior ocelli, the prealar bristle more than half as long as the bristle behind it, the costal thorn longer than inner cross-vein; the whole disc of third sternite of abdomen with long, bristly, downwardly directed hairs, and the hind tibia with three long bristles on the antero-dorsal surface.

**Hylemyia substriata** Stein

1897. *Chortophila substriata* Stein, Berl. Ent. Zeit., xlii, 233.

One male which agrees in all particulars with the type, which is before me, bears data as follows: Berkeley Hills, Alameda County, California, March 22, 1908.

There are also two females which belong to this species from Cloudcroft, New Mexico, May 26, 1902.

**Hylemyia** sp.

This species closely resembles *substriata* Stein, but there are only one male and two females in poor condition in the collection, so that it is impossible to identify it accurately.

Locality; Bright Angel, Arizona, rim of Grand Cañon, 6880 feet, July 29 to August 2, 1906, (P. P. Calvert).

**Hylemyia** sp.?

One male, similar in appearance to the last one except that there is no strong pair of presutural acrostichal bristles. The hind tibiae in both of these species are rufous.

This species has the fore and mid legs glued to the point on which it is mounted, so that it is impossible to satisfactorily identify it.

Locality; Beulah, New Mexico, June 28, 1902, top of range.

**Hylemyia curvipes** sp. n.

*Male.*—Black, densely gray pruinose. Head black, frons, face, orbits, and cheeks with silvery pruinescence; antennae and palpi black. Thorax with three or five brown vittae. Abdomen with a black dorso-central stripe and the anterior margin of each segment narrowly black; hypopygium glossy black. Legs black. Wings clear, veins black. Calyptra white. Halteres dull yellow.

Eyes separated by a little more than width of anterior ocellus; parafacial in profile over half as wide as third antennal joint, width of the latter over half as great as height of cheek, marginal bristles of cheek in a single series anteriorly where they are upwardly curved; face vertical or almost so, one to two short hairs above vibrissa. Three pairs of presutural acrostichals present; prealar bristle less than half as long as the bristle behind it. Abdomen depressed, narrow; fifth sternite with a few, long, backwardly directed bristles on disc, each process rounded at apex, slightly chitinous, glossy, and with a stout, blunt, downwardly directed spine near apex on ventral surface. Legs slender, the hind femora very much curved; fore tibia with one to three postero-ventral bristles; mid femur with six to eight long bristles on basal half of postero-ventral surface; mid tibia with one antero-dorsal, two to three

postero-dorsal, and two to four postero-ventral bristles, the dorsal surface on apical half and dorsal surface of basal joint of mid tarsus each with long setulose hairs; anterior surface of hind femur with short, erect, setulose hairs, which become longer on apical half of antero-ventral surface; hind tibia with a series of erect setulose hairs on each of the following surfaces, antero-ventral, anterior, antero-dorsal, posterior, and postero-ventral, postero-dorsal surface with four widely placed slender bristles. Veins 3 and 4 convergent apically; outer cross-vein nearly straight. Length, 4 to 4.5 mm.

*Type.*—♂; Grand Tower, Illinois, April 21 to 23, 1914, [Illinois]. *Paratypes.*—1 ♂, topotypical; 2 ♂, Lafayette, Indiana, May 1, 1918, [Illinois].

This species bears a resemblance to *trichodactyla* Zetterstedt, but the hind femora are very much curved, and the armature of the hind tibiae is quite different.

**Hylemyia fusciceps** Zetterstedt

1845. *Aricia fusciceps* Zetterstedt, Dipt. Scand., iv, 1552.

The commonest and most widely distributed anthomyiid fly in North America. Represented by sixty-seven specimens from the following localities: Milbrae, Redwood Cañon, Lagunitas Cañon, Mesa Grande, Sonoma County, Yosemite Valley, and Berkeley Hills, all in California; Beulah, top of Las Vegas Range, Alamogordo, Highrolls, East Las Vegas, and Clouderoft, all in New Mexico.

**Hylemyia** sp.?

One female resembling in most respects that of *fusciceps* Zetterstedt, but with fewer antero-dorsal bristles on hind tibiae.

Locality; Huachuca Mountains, Arizona, August, 1905, (H. Skinner).

## Subfamily Fucellinae

### FUCELLIA R.-D.

There are two species of this genus in the collection. One of these is undescribed.

**Fucellia assimilis** sp. n.

*Male* and *female.*—Black, densely gray pruinescent. Head grayish testaceous, becoming ochreous anteriorly, the entire face, anterior half of frons and the cheeks reddish testaceous; third antennal joint and proboscis black. Dorsum of thorax with three narrow brown vittae. Abdomen with a blackish brown dorso-central vitta; bases of setulae and bristles each surrounded by a black dot; fifth sternite testaceous in male. Legs black,

trochanters and tibiae reddish testaceous. Wings hyaline, in the male with a large brown mark extending on costa from slightly beyond level of inner cross-vein to apex of wing, filling nearly all the area from apex of fourth vein to costa and backward to near outer cross-vein; no such mark on wings of female. Calyptra white. Halteres yellow.

*Male.*—Head distinctly broader than thorax, and nearly twice as broad as long at center of frons; one pair of bristles on interfrontalia; each orbit with five bristles; antennae short, barely more than half as long as face, third joint rounded apically; arista bare; vibrissal angle midway between upper mouth margin and apex of third antennal joint; cheek nearly as high as eye, marginal bristles sparse and strong. Mesonotum with three pairs of presutural acrostichals; lower two sternopleurals about half as long as upper two. Hypopygium small, retracted; fifth sternite with a deep, broad, rounded central excision. Fore tibia with one antero-dorsal and one posterior bristle; mid tibia with one antero-dorsal and two postero-dorsal bristles; hind femur with three to four very widely spaced antero-ventral bristles on apical half; hind tibia with two to three antero-ventral, six to seven antero-dorsal, and three to four postero-dorsal bristles. Veins of basal half of wing weak, the costa noticeably so, especially between apex of auxiliary vein and apex of first; the strong costal spines on under side of costa present only from the beginning of the dark mark on wing to apex. Third and fourth veins parallel on apical portion.

*Female.*—Differs from male in having the head about equal in width to thorax, the orbits with six bristles, the wing venation normal, the costal thorn distinct; and the spines on costal vein present from a short distance beyond apex of first vein to apex of second. Length, 4.5 mm.

*Type.*—♂; San Francisco, California, August 7, 1908, (F. E. Blaisdell), [A. N. S. No. 6220]. *Allotype.*—Same locality, May 27, 1908, (F. E. Blaisdell).

This species is very similar to *apicalis* Stein, a Chinese species, but differs in color and chaetotaxy of the legs. Stein makes no mention of any peculiarity of wing venation in *apicalis* such as is described above.

**Fucellia maritima** Haliday

1838. *Halithea maritima* Haliday, An. Nat. Hist., i, (2), 186.

Two males and two females, San Francisco, California, August 7, 1908, and May 27, 1908, (F. E. Blaisdell).

This is the most widely distributed species in this country. I have seen it from the Gulf Coast in Texas, and various points on the Atlantic and Pacific coasts and have taken it on the Little Wabash River in Illinois and on the shores of Lake Michigan. The species occurs also in Europe.

## Explanation of Plate XVII

Fig. 1.—*Xenaricia fulva*, genital segments of female, caudal view.
Fig. 2.—*Xenaricia fulva*, same, lateral view.
Fig. 3.—*Hylemyia substriatella*, hypopygium of male, lateral view.
Fig. 4.—*Hylemyia duplicata*, same.
Fig. 5.—*Hylemyia marginella*, fifth abdominal sternite of male, ventral view.
Fig. 6.—*Hylemyia pilosceta*, same.
Fig. 7.—*Hylemyia spinilamellata*, same.
Fig. 8.—*Hylemyia marginata*, same.
Fig. 9.—*Hylemyia spinilamellata*, hypopygium of male, dorsal view, one side.
Fig. 10.—*Hylemyia marginella*, same.
Fig. 11.—*Hylemyia marginata*, same.
Fig. 12.—*Hylemyia, piloseta*, same.

# CONTENTS

A Study of the North American Eumastacinae (Orthoptera; Acrididae). By James A. G. Rehn and Morgan Hebard . . . . . 223
(Issued September 30, 1918.)

A Rare Coleoptera Paper of T. W. Harris. By George M. Greene . . . . . 251
(Issued September 30, 1918.)

Diptera from the Southwestern United States. Paper IV. Anthomyiidae. By J. R. Malloch . . . . 263
(Issued October 28, 1918.)

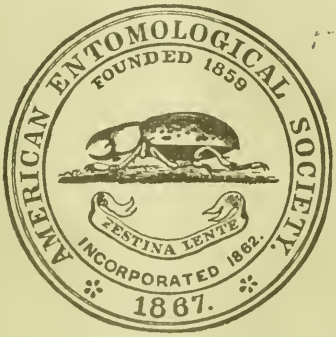
VOLUME XLIV NUMBER 4

DECEMBER 1918

# TRANSACTIONS

OF THE

# AMERICAN ENTOMOLOGICAL SOCIETY




Smithsonian Institution
JAN 14 1919
National Museum

PUBLISHED BY THE AMERICAN ENTOMOLOGICAL SOCIETY AT THE
ACADEMY OF NATURAL SCIENCES

PHILADELPHIA

SUBSCRIPTION PRICE FOUR DOLLARS PER VOLUME

# THE AMERICAN ENTOMOLOGICAL SOCIETY

PHILADELPHIA

Founded 1859 Incorporated 1862

Organized as "The Entomological Society of Philadelphia," the present title was adopted February 11, 1867.


PRESIDENT
Henry Skinner

VICE-PRESIDENT
James A. G. Rehn

CORRESPONDING SECRETARY
Morgan Hebard

RECORDING SECRETARY
George M. Greene

TREASURER
Ezra T. Cresson

PUBLICATION COMMITTEE
James A. G. Rehn
*Editor*
Ezra T. Cresson
Philip P. Calvert

FINANCE COMMITTEE
James A. G. Rehn
*Chairman*
D. M. Castle
Morgan Hebard

PROPERTY COMMITTEE
Ezra T. Cresson, Jr.
*Librarian* and *Custodian*
Morgan Hebard
Philip Laurent


Meetings held (alternately with those of the Entomological Section of the Academy of Natural Sciences of Philadelphia) on the fourth Thursday of September, October, November, January, February, March, April and May, and on the second Monday of June and December (annual meeting). The offices, meeting room, library and collections of the Society are in the Entomological Department of the Academy of Natural Sciences of Philadelphia, Logan Square.

## SERIAL PUBLICATIONS OF THE SOCIETY

Proceedings of the Entomological Society of Philadelphia, volumes I–VI, 1861–1867. Out of print and cannot be supplied.

Transactions of the American Entomological Society, volumes I–IV, out of print and cannot be supplied; V–X, $5.00 per volume; XI–XLIV, $4.00 per volume. Published in annual volumes of quarterly parts.

The Practical Entomologist, volumes I–II, 1865–1867. Price, $1.00 for the two volumes.

Memoirs of the American Entomological Society, number 1, 1916, price $2.00; number 2, 1917, price $4.50. Published irregularly.

Entomological News, volumes I–XXIX. Price $2.00 per volume. Published in conjunction with the Entomological Section of the Academy of Natural Sciences of Philadelphia.

Various irregular, non-serial publications have been issued, which may be found in our price lists under their respective authors.

To establish the date of issue, each paper, as soon as completed, is placed on sale and a copy of it is mailed to each of the following institutions, with a request that it be placed in their library for reference.

Boston Society of Natural History
American Museum of Natural History
Smithsonian Institution
Field Museum of Natural History
California Academy of Sciences
Entomological Society of Ontario

Separates of papers published in the Proceedings and Transactions, if not out of print, can be supplied at prices given in our price lists, which are sent upon application, stating order or orders desired. The Society has also inaugurated a system of subscription to papers published by it on individual orders, which arrangement is of material benefit to the student who desires promptly the literature on any special group, but who does not desire to subscribe to entire volumes of the Transactions. A method of notification of the appearance in its publications of papers relating to individual orders or subjects has been developed by the Society. Information concerning these arrangements supplied upon application.

In sending subscriptions or in making inquiries relative to publications, address:

THE AMERICAN ENTOMOLOGICAL SOCIETY,
PUBLICATION DEPARTMENT,
The Academy of Natural Sciences of Philadelphia,
Logan Square.

# DESCRIPTIONS OF ONE NEW GENUS AND FIFTEEN NEW SPECIES OF TROPICAL AMERICAN ORTHOPTERA

BY JAMES A. G. REHN

The new forms described in the present paper have been encountered in making certain comparative examinations, necessitated in the preparation of papers which have recently appeared or are now in preparation. The greater portion of the new species are based on material forming part of several extensive series, which, for various reasons, it is not possible to fully study at this time. It seems advisable, however, that the new descriptions should appear, particularly as it is necessary to quote certain of them in other papers now awaiting publication. All of the new forms are based on material from the collection of the Academy of Natural Sciences of Philadelphia, where the types are located.

Seven of the species described are Costa Rican and eight are from various localities in South America.

## BLATTIDAE

The following species was distributed to a number of collections in Europe and America by the late Dr. Saussure, under the manuscript name of *E. carbonaria*. This latter name was never adequately proposed, and it seems most fitting in fully describing the species to commemorate the name of the student who assisted in bringing it, and numerous similar discoveries in the zoology of his adopted country, to the attention of others—Prof. Pablo Biolley.

**Eurycotis biolleyi** new species (Pl. XVIII, figs. 1, 2, 3 and 4.)

1896. *Eurycotis carbonaria* Tristan, Informe Mus. Nac. Costa Rica, 1896, p. 15. [La Palma and Azahar de Cartago, Costa Rica.] (Nomen nudum.)

1900. *Eurycotis carbonaria* Biolley, *Ibid.*, 1899–1900, p. 46. [La Palma and Azahar de Cartago, Costa Rica.] (Insufficient, three word characterization.)

Allied to *E. mexicana* (Saussure), from the Eastern Cordillera and Plateau of Mexico, but differing in the more angulate and less rounded apices of the tegmina, in the proportionately broader



Smithsonian Inst

abdomen, in the greater interspace between the eyes, in the pronounced depression and expansion of the caudal tibiae of the male, in the more elongate and slender median and caudal tarsi, in the caudal metatarsi of the male being subequal in length to the remainder of the tarsus, instead of distinctly shorter as in *mexicana*, in the supra-anal plate of the male being proportionately broader, in the subgenital plate of the male being transverse with the distal margin broadly truncate, instead of trigonal with the apex narrow and V-emarginate as in *mexicana*, and in the apices of the cerci of the female surpassing the supra-anal plate, instead of subequal to the same as in *mexicana*.

The expansion of the caudal tibiae of the male recalls *E. tibialis* Hebard,[1] from Hispaniola, but in the present species the expansion is more regular and the dorsal surface bears a deep longitudinal groove, instead of a shorter ovate depression as in *tibialis*, in which species this expansion is equally marked in the female. From *tibialis*, however, the present species is quite distinct, the size being much less, the abdominal form different, the form of the supra-anal plate of the male and details of the head not as in *tibialis*.

*Type*.—♂; Pacayas, Costa Rica. Elevation, 1430 meters. April, 1906. (P. Biolley; no. 39.) [Academy of Natural Sciences of Philadelphia, Type no. 5351.)

Size medium: form elliptical, depressed: surface polished.

Head with the occiput regularly arcuate transversely; interspace between the eyes very broad, equal to the length of the head from the occiput to the clypeal suture, the interspace between the ocellar spots distinctly less than that between the eyes; eyes reversed reniform, subpyriform in basal outline, this rectangulate at the dorso-cephalic angle; antennae subequal to the body length.

Pronotum of the form usual in the genus; cephalic margin subtruncate in the greater portion of the supra-occipital region, caudal margin arcuato-truncate mesad, subtruncate laterad; lateral and cephalic margins narrowly cingulate. Mesonotum and metanotum of the type usual in the genus. Tegmina not surpassing the caudal margin of the mesonotum, lateral, their length almost twice their greatest width; external margin slightly arcuate, weakly cingulate, apex rectangulate, internal and distal margin regularly arcuate. Wings absent.

Abdomen very short ovate, more deplanate than the thoracic segments, disto-dorsal abdominal segments with distinct but not strongly pronounced caudad projections of the cauda langles. Supra-anal plate distinctly transverse, the greatest length contained nearly two and one-half times in the proximal

[1] Entom. News, xxvii, p. 264, pl. xiv, fig. 1 and text fig., (1916).

width of the plate; lateral supra-cercal emarginations of the plate decided, the median portion trapezoidal, the distal margin sinuato-truncate, the lateral angles of the same broadly rounding into the lateral margins of that area: cerci broad, depressed fusiform, the apex moderately acute, in length surpassing the margin of the supra-anal plate by about two-thirds the length of the latter: subgenital plate strongly transverse, the portion between the styles somewhat produced distad of the insertion of the styles and broadly truncate with the lateral angles rounded obtuse-angulate; styles elongate, simple, tapering.

Cephalic femora with the ventro-cephalic margin bearing a regular series of spines except proximad. Median femora with both ventral margins regularly and strongly spined; median tibiae subdepressed; median tarsi with the metatarsus distinctly shorter than the remaining joints together. Caudal femora with the armament of the margins as in the median limbs; caudal tibiae depressed, elongate subfusiform in general outline, the surface of the dorsal and of the ventral faces with a broad, longitudinal impressed area of a general boat-shaped character; caudal tarsi elongate, the metatarsus almost subequal in length to the remainder of the tarsus.

*Allotype.*—♀; Tablazo, Costa Rica. Elevation, 1900 meters. September, 1906. (J. F. Tristán.) [Acad. Nat. Sci. Phila.]

Differing from the description of the male in the following features. General form with the abdomen faintly broader in proportion than in the male. Abdomen with the caudo-lateral angles of the dista-dorsal segments more produced than in the male. Supra-anal plate subtrigonal in general form, moderately projecting, faintly rostrate, tectate distad, the dorsal surface there briefly subcarinate; converging lateral margins of the plate appreciably concave proximad, the distal portion of the margin broadly V-emarginate, this rounding laterad into the lateral margins proper: cerci depressed broad-fusiform, in length reaching to the extremities of the subgenital valves, apices acute: subgenital plate very ample, the valvate portion occupying slightly more than half the length of the plate, basal suture of the valves occupying about one-half the entire width of the plate. Caudal tibiae moderately depressed, not at all expanded as in the male and without impressed areas on the dorsal and ventral faces.

General color varying from hessian brown to pitch black, in the paler individuals the thoracic and abdominal segments, the coxae and the tegmina narrowly edged with pitch black; apex of the abdomen entirely or largely pitch black in those which show any color contrasts, the subgenital and supra-anal plates of the male sex lined on the distal margin, and the cerci of both sexes tipped with ochraceous, this latter coloration varying to a certain degree. Distal tarsal joint of all tarsi, the arolium and claws of the same with the base color ochraceous-orange, the extremity of the joint, and to a less decided or constant degree the arolium and claws, infuscate.

| | Length of body | Length of pronotum | Greatest width of pronotum | Length of tegmen | Length of caudal tibia | Length of caudal tarsus |
|---|---|---|---|---|---|---|
| ♂ | | | | | | |
| Pacayas, *type* | 20.5 mm. | 6 mm. | 8.9 mm. | 3.2 mm. | 7.3 mm. | 5.1 mm. |
| Santa Maria de Dota, *paratype* . . . | 23.2 | 6.7 | 10.3 | 3.8 | — | — |
| Cartago, *paratype* . . . . . | 24.2 | 6.2 | 9 | 3.4 | 8 | — |
| Monte Redondo, *paratype* | 18.7 | 5.7 | 8.3 | 3 | 6.6 | 4.2 |
| ♀ | | | | | | |
| Tablazo, *allotype* . . . . . | 20.2 | 6.1 | 9.4 | 3.7 | 7.7 | 5.6 |
| La Palma, *paratype* . . | 27 | 7.9 | 11.5 | 4.6 | 10.5 | 7.9 |
| La Palma, *paratype* . . | 26 | 6.4 | 9.4 | 4.2 | 8 | 6 |
| Pacayas, *paratype* . . . . . | 23 | 6.3 | 8.9 | 3.5 | 8 | — |
| Pacayas, *paratype* . . . . . | 25.2 | 6.2 | 9.6 | 4 | 8 | — |
| Santa Maria de Dota, *paratype* . . | 25.8 | 6.5 | 10 | 4.2 | 8.8 | 5.6 |
| Santa Maria de Dota, *paratype* . . | 26 | 6.9 | 10 | 4 | 8 | 6 |
| Navarro, *paratype* . . . . . | 21 | 6.5 | 9.7 | 4 | 8.5 | 5.3 |

In addition to the type and allotype we have before us a series of four adult males and one immature male, twelve adult females and fourteen immature females. Of these three adult males and eleven adult females have been considered paratypes, the adults not considered paratypes being teneral or without exact locality. The localities represented by these specimens are as follows:

Pacayas, Costa Rica. Elevation, 1430 meters. April, 1916. (P. Biolley.) One male (*type*), two females (*paratypes*). [A. N. S. P.]

Tablazo, Costa Rica. Elevation, 1900 meters. September, 1906. (J. Fidel Tristán.) Four females (*allotypes* and two *paratypes*). [A. N. S. P.]

La Palma, Costa Rica. Elevation, 1600 meters. May, 1906; June, 1908. (J. Fidel Tristán.) Two females (*paratypes*). [A. N. S. P.]

Itiquis, Costa Rica. April 19, 1916. (A. Alfaro.) One female (*paratype*). [A. N. S. P.]

Cartago, Costa Rica. May 31, 1909. (P. P. Calvert.) One male (*paratype*). [A. N. S. P.]

Monte Redondo, Costa Rica. March, 1902. (L. Bruner.) One male (*paratype*); one immature male and two immature females. [Hebard Cln.]

Santa Maria de Dota, Costa Rica. January, 1909. (J. Fidel Tristán.) One male (*paratype*), two females (*paratypes*) and nine immature females. [A. N. S. P.]

Navarro, Costa Rica. (J. Fidel Tristán.) One female (*paratype*). [A. N. S. P.]

San José, Costa Rica. September, and October 24, 1915. (A. Alfaro; one in crown of dry jocoto (*Spondias purpurea*).) One female (*paratype*); one immature female. [A. N. S. P.]

Tiribi, Costa Rica. April, 1916. (A. Alfaro.) One immature female. [A. N. S. P.]

Costa Rica. Labelled "Eurycotis carbonaria Sss." One male; one immature female. [A. N. S. P.; received from Dr. Saussure.]

From the above data it is evident the species is rather widely distributed at moderate elevations in the central mountain and table-land region of Costa Rica.

The features of variation which are evident from the series are: size variation, which is demonstrated by the table of measurements given above; the width of the face and the interocular region, which latter, especially in the male sex, is slightly narrower or distinctly broader than described above, the maximum width being in the male paratype from Santa Maria de Dota, in which the width between the eyes is appreciably greater than the depth of the face from the occiput to the clypeal suture, the whole head being broader than average and correlated with an unusually wide pronotum; caudo-lateral production of the disto-dorsal abdominal segments, which in the female sex show appreciable variation, in one of the La Palma females these being so sharply produced as to be sub-spiniform; color fluctuations, described above.

## MANTIDAE

### POGONOGASTER[2] new genus

A member of the *Miopteryginae*, belonging to the oligonyeine section, but in no way closely related to any of the known genera. It is however, apparently, more nearly related to *Harpagonyx*, *Spanionyx* and *Thrinaconyx* than to any of the other genera. From all of these it may be distinguished by its truncate occiput, which also lacks angulate juxta-ocular lobes; by the form of the pronotum, which seen in lateral aspect is subsigmoid, recalling the Old World genus *Toxodera;* by the tuberculate dorsum of the pronotum; by the considerably developed triangular supra-coxal expansions of the pronotum; by the abdomen having a medio-dorsal series of foliaceous expansions and occasionally similar lateral expansions, and by features of the cephalic tibial spine formula.

The genus is most aberrant in general form and appearance, and would appear at first glance to have little in common with the genera with which it is here associated. More careful study shows, however, that the affinity of *Pogonogaster* is with the oligonyeine miopterygids.

*Description of the Genus.*—(Female sex alone known.) Head transverse; occiput straight, with rounded juxta-ocular elevations; ocelli minute (♀), in broad triangle; facial scutellum transverse; eyes rounded. Pronotum elongate, sigmoid in lateral view; supra-coxal expansions decided, acute, sub-foliaceous; dorsal surface bearing on the collar a median and a postmedian paired tubercle or a single low swelling, on the shaft a pair of decided tubercles mesad at the caudal margin; shaft with a distinct median carina; all margins serrate or serrulate. Tegmina and wings in adult (♀) probably undeveloped or abbreviate. Abdomen with the dorsal segments having the caudal margins developed mesad on the proximal segments into erect foliaceous structures, which distad are expanded and the margins are serrato-dentate, on the distal segments the structures are merely projecting folds of the margin; lateral the dorsal segments may or may not develop proximad a series of structures similar to the median ones: venter of the abdomen with a series of median folds of the caudal margins of the segments: supra-anal plate (♀)

[2] From πωγων beard, γαστηρ belly.

linguiform, tectate, carinate dorsad. Cephalic femora with distal five-eighths very slender; discoidal spines three in number: cephalic tibiae abbreviate, not a third as long as the femora, in addition to the claw with an internal, an external and two distal spines, proximal portion of the ventral margin with a series of several small denticulations. Median and caudal limbs elongate; femora faintly swollen in the pregenicular region; genicular lobes produced, rounded acuminate; caudal metatarsi forming distinctly more than half of the entire tarsal length.

Genotype.—*P. tristani* new species.

**Pogonogaster tristani** new species (Pl. XVIII, figs. 5 and 6; pl. XX, fig. 1.)

*Type.*—♀; La Palma, Costa Rica. Elevation, 1600 meters. May, 1906. (J. Fidel Tristán.) [Academy of Natural Sciences of Philadelphia, Type no. 5353.]

Size medium: form moderately elongate, abdomen fusiform: surface unpolished.

Head in general form transverse, subtrigonal: occiput when seen from the cephalic aspect transverse truncate, with very low and rounded juxta-ocular swellings: front dorsad of the ocelli with a fine but decided, transverse arcuate carination: facial shield strongly transverse, low, the width at least three times the greatest depth, dorsal margin arcuate, dorso-lateral angles obtuse: clypeus produced in a conical tubercle: eyes prominent, almost semicircular in outline when seen from the front, when seen from the dorsum the eyes are subglobose, when seen in lateral view the eyes are ovate in basal outline: antennae imperfect, proximal joint small.

Pronotum when seen from the dorsum has the general form elongate cruciform, the greatest width across the supra-coxal expansion subequal to the length of the collar and about two-fifths of the entire pronotal length, when seen from the side the pronotum is bisigmoid, the collar and the caudal extremity ascending, the portion between gently arcuate dorsad: collar with the margin well-rounded cephalad, faintly narrowing at the middle of the collar, thence regularly expanding to the acute apices of the supra-coxal expansions, the latter subfoliaceous and arcuate dorsad; shaft regularly narrowing from the maximum width of the supra-coxal expansions to about the cephalic two-fifths of the shaft, thence regularly but very slightly expanding to the caudal extremity, the caudal margin arcuato-truncate: surface of the pronotum with, on the shaft a decided median conical tubercle and a smaller but similar one cephalad of the median protuberance, on the shaft at the caudal margin is situated a pair of closely placed, prominent, rounded tubercles; collar with a faint median carina, shaft with a distinct and continuous median carina, which at the cephalic two-fifths and at the caudal four-fifths develops small, erect, rounded lobes, the cephalic one the larger; serrulations of the margins more regular and numerous on the collar and caudad on the shaft, sparser cephalad

on the shaft, on the supra-coxal expansions more crenulato-serrulate. Tegmina and wings represented by well-veined lateral pads: mesonotum and metanotum with a distinct median carination.

Abdomen with the median line of the second, third and fourth segments of the abdomen bearing highly developed, erect, foliaceous appendages, which each consist of a single thickness cephalad and lateral wings to the same caudad, the wings more ample than the single portion and also broader distad than proximad, the margins of the appendages with numerous digitiform points, the appendage on the fourth segment smaller than the other two; fifth to ninth segments with the median line bearing low appendages, which are more nearly erect fold of the integument than true lobes, of these that on the fifth is the largest, those on the sixth to ninth regularly increasing in size, the sixth the smallest: lateral appendages developed on the second to seventh segments, those on the second to fourth segments very similar in character to those on the median line, but somewhat smaller, those on the other segments simple deplanate lobes with the margins crenulato-digitate: ventral abdominal segments with a median fold of the integument at the caudal margin: supra-anal plate elongate linguiform, decurved, subtectate, carinate mesad: cerci simple, not tapering, not reaching to the apex of the supra-anal plate: subgenital plate relative short, of the usual rostrate mantid type.

Cephalic coxae three-fourths as long as the pronotum, slightly inflated proximad, more slender distad, internal face with the distal lobe moderately developed, margins sparsely denticulate: cephalic femora slender, faintly sigmoid, distal five-eighths tapering, very slender; median discoidal spine the longest of the three; external margin with five spines, of which the distal one is much the shortest; internal margin with nine spines arranged in this formula (reading from the distal extremity) iIIIIIIi; margins of the cephalic femora, other than those sections bearing the regular spine series, sparsely denticulate, the medioventral one distinctly and regularly serrato-dentate: cephalic tibiae (without claw) not quite one-third as long as the femur, subsigmoid, the apical claw large, slender, moderately falcate; dorso-distal section with a prominent, falcate spine and a smaller, straight spine immediately ventrad of the larger spine and on the internal face; internal margin with a single median, large, straight oblique spine; external margin with a single straight spine distad; ventral margin proximad with three minute serrulations: cephalic tarsi incomplete. Median and caudal limbs very slender and elongate: femora subcompressed and faintly arcuate immediately before the distal extremity; genicular lobes subacuminate: caudal tarsi very faintly shorter than the tibiae, very slender, the metatarsus comprising five-eighths of the tarsal length.

General color antimony yellow, becoming dull buckthorn brown on the abdomen, the shaft of the pronotum washed with ferruginous; limbs of the body color passing into weak and pale turtle green, the spines fuscous tipped; head with the occiput washed with dull mummy brown, eyes dresden brown.

Length of body, 25.5 mm.; length of pronotum, 8.3; length of cephalic femur 7.5; length of caudal femur, 8.3.

The type of this interesting species is unique.

## ACRIDIDAE

**Diedronotus centralis** new species (Pl. XVIII, figs. 7 and 8.)

Closely related to *D. angulatus* and *mexicanus*, agreeing with these in the general form and height of the pronotum, but differing from the former in the proportionately more elongate pronotum, which has the lateral angles of the disk less produced, in the angle of the caudal margin of the disk being less decidedly produced, in the higher median pronotal carina, in the broader, nearly sub-rectangular fastigium (when seen from the dorsum), in the more rounded fastigio-facial angle, in the hardly sulcate frontal costa, in the less elongate and blunter tegmina and wings, and in its larger size. From *mexicanus*, with the allotype of which it has been compared, the new species differs in the pronotum being more longitudinal with the lateral angles of the disk less angulate and more rounded, in the median carina of the same slightly lower but of the same general type, in the head being broader, in the fastigium having its dorsal form more nearly rectangulate, in the head as a whole being broader, in the frontal costa being but faintly sulcate, in the eyes more reniform-ovate in basal outline, in the much more rounded fastigio-facial angle, in the more inflated proximal portion of the caudal femora and in the larger size.

The species is quite distinct from *D. discoideus* and *rosulentus*, both of which, while related, can be readily distinguished from *centralis* by their much more elongate pronotum and the very distinctly lower median carina of the same.

*Type.*—♀; El Pelón, Guanacaste, Costa Rica. January, 1915. (P. Biolley.) [Academy of Natural Sciences of Philadelphia, Type no. 5354.]

Size large; form subcompressed; surface in general weakly cribroso-punctulate.

Head with occiput vaulted, descending cephalad to the weakly declivent fastigium, width between the eyes equal to three-fourths of the depth of the eye; fastigium when seen from the dorsum slightly acute-angulate, surface non-excavate; when seen from the side the fastigio-facial angle is rounded rectangulate; frontal costa relatively narrow dorsad, moderately expanding to between the antennae, subequal thence to immediately ventrad of the ocellus, weakly indicated from that point to the clypeal suture, the margins there hardly indicated, surface of costa very faintly sulcate for a short distance ventrad and dorsad of the ocellus; supplementary facial carinae rather delicately indicated, diverging ventrad; eyes but little prominent when seen from

the dorsum, reniform in basal outline, depth subequal to that of the infra-ocular sulcus: antennae in length equal to about five-sixths of the greatest length of the dorsum of the pronotum, moderately depressed, apex bluntly acuminate.

Pronotum with median carina strongly elevated and regularly arcuate, the highest point of crest above the caudal angles of the lateral carinae equal to three-fifths the greatest width of disk across these angles, caudal portion of median crest crenulate, elsewhere the margin is smooth, with principal sulcus deeply and narrowly bisecting the same, the sulci of prozona (two) intersecting but not dividing the crest; greatest width of disk (across the caudal angles of the lateral carinae) contained nearly twice in the greatest length of the same; cephalic margin of disk rectangulate mesad, the lateral portions of this margin gently concave; caudal margin of disk elongate produced acuminate, the lateral portions of the margin weakly concave; lateral carinae of the disk decided, regularly diverging caudad to the distinct angle immediately before the caudal margin is reached, these margins bluntly crenulato-serrulate; surface of the disk with regularly placed elevated spiculate points: lateral lobes of pronotum with greatest depth equal to three-fourths of the greatest dorsal length; cephalic margin of lobes weakly sinuate, ventro-cephalic angle obtuse, ventral margin obliquely sinuato-truncate cephalad, weakly arcuate caudad, ventro-caudal angle rounded, caudal margin of the lobes obliquely concavo-truncate; surface of the lobes appreciably concave immediately ventrad of the lateral carinae of the disk. Tegmina very faintly surpassing the apices of the caudal femora, of the form usual in the genus, the greatest width of tegmen contained four and one-half times in the greatest length of the same; costal margin with a decided basal lobe at proximal fourth, apex rectangulate, well arcuate on costal side, oblique truncate on sutural side, sutural margin straight in greater part; secondary venation and reticulation involved and delicate, no intercalary vein present. Wings reaching to the apices of the tegmina when the organs of flight are in repose, when expanded the wings are relatively narrow, the greatest width contained nearly twice in the greatest length of the same; apex slightly acute, distal margin of anterior field oblique truncate; distal margin of axillary field strongly arcuate sub-lobate; peripheral margin of radiate field weakly crenulate, becoming crenate distad. Prosternal spine strongly compressed, in distal section slightly expanded cephalo-caudad, the apex slightly acute and caudal in position: interspace between the mesosternal lobes distinctly narrower than the individual lobes, subquadrate, the point of least width slightly cephalad of the middle, meso-caudal angle of lobes obtusely rounded: interspace between the metasternal lobes moderately transverse, short, slightly narrowed caudad.

Ovipositor jaws short, robust, distad sharply curved dorsad (dorsal valves) or ventrad (ventral valves).

Cephalic and median limbs rather slender, for the relatively heavy body of the insect. Caudal femora equal in length to slightly more than one-half of

the body length, of the form usual in the genus, greatest depth contained four and one-half times in the greatest length, subcompressed, dorsal margin markedly serrulate, genicular lobes acuminate: caudal tibiae slightly shorter than the femora, armed on the external margin with eleven to twelve spines, on the internal margin with ten spines, those of the internal margin appreciably longer than those of the external margin; internal spurs with the ventral one and one-half times as long as the dorsal one, external spurs smaller, subequal.

General coloration ranging from dresden brown frosted with ochraceous-tawny and warm buff (paratype) to ochraceous-tawny passing on the pronotum, pleura, tegmina and caudal femora to ferruginous (tawny). Pronotum with the medium and lateral carinae as well as the margins of the lateral lobes edged with ochraceous-buff. Eyes chestnut. Tegmina with a single well-marked transverse figure at the proximal fourth, this made up of one or two large figures in the discoidal field and a smaller but sharply defined dot in the marginal field, distad of this group regular and oblique transverse bars are weakly indicated. Wings with the disk of radiate field pale spectrum red (paratype) to jasper red (type), this also present as a wash on the proximal half of the anterior field and faintly so on the same section of the axillary field, band of fuscous not wide but regularly arcuate, reaching to the proximal section of the peripheral margin, the spur well indicated and extending nearly to the base of the wing, but the infuscation is there weakened; distal section of the wing infuscate (paratype) or subhyaline (type). Caudal tibiae wood brown to army brown, the spines naples yellow to mustard yellow and black tipped.

*Measurements (in millimeters)*

| ♀ | Length of body | Length of pronotum | Greatest width of pronotal disk | Length of tegmen | Length of caudal femur |
|---|---|---|---|---|---|
| El Pelón, *type*..... | 56 | 19.7 | 10.1 | 42 | 32.5 |
| Guanacaste, *paratype*... | 54.9 | 19.4 | 10 | 41 | 32 |

In addition to the type we have a female individual, labelled simply "Guanacaste," Costa Rica (January, 1915; A. Alfaro), which we consider paratypic. This specimen shows no features of difference from the type, excepting those of color mentioned above and the presence of as many as eleven spines on the internal margin of the caudal tibiae.

**Coscineuta matensis** new species (Pl. XVIII, figs. 9, 10 and 11; pl. XX, fig. 2.)

Closely related to *C. sordida* Rehn,[3] from north-eastern Brazil, but differing in the more decided scrobiculation of the genae, pronotum and pleura, in the proportionately broader and shorter tegmina, in the produced and more attenuate ovipositor jaws of the female, these being straighter, blunter and with the usual

marginal serrulations weakly or not at all indicated, in the presence of yellow instead of red on the dorsal surface of the abdomen in both sexes, and in the absence of a decided yellow line along the ventral margin of the external pagina of the caudal femora, as found in *sordida*.

When compared with *C. coxalis* (Serville), the present species is seen to differ in numerous features of the coloration, in the metazona of the pronotum being distinctly shorter than the prozona, instead of subequal as in *coxalis*, and in the specialized structure of the ovipositor jaws of the female. The species *sordida* and *matensis* are members of a species group well removed from *coxalis*.

*Type*.—♀; Rio Mato, Venezuela. October to November, 1909. (M. A. Carriker Jr.) [Academy of Natural Sciences of Philadelphia, Type no. 5315.]

Size relatively large: form robust: surface of head, pronotum and pleura rugoso-cicatricose, scattered sections of the same sub-strumose, the impressions producing a decided scrobiculation.

Head very similar to that of *C. sordida* but proportionately broader across both the eyes and the genae: fastigium strongly declivent, much more so than in *sordida*, when seen from the dorsum the surface of the fastigium is distinctly bifoveolate with a median ridge; when seen from the side the interantennal portion of the frontal costa is not at all produced and rounds regularly into the weakly arcuate line of the face; when seen from the front the interantennal portion of the frontal costa is slightly narrower than in *sordida*, while the strumose character of the ventral section of the frontal costa, of the face and supplementary carinae of the same is less decided than in *sordida*, being more broken into separated nodes: eyes moderately prominent, flattened short elliptical in basal outline, the greatest depth contained nearly twice in that of the infra-ocular sulcus: antennae over twice as long as the dorsum of the pronotum, slender.

Pronotum quite short, robust, scrobiculose-cicatricose: greatest dorsal width of disk contained slightly more than one and one-fifth times in the length of the same; cephalic margin of the disk with a weak median emargination, caudal margin of the disk arcuate with a very faint angulation mesad; median carina weak, but faintly more evident than in *sordida* and not so much confused with the strumose pattern; transverse sulci less evident than in *sordida*, narrower: lateral lobes of the pronotum slightly narrower in proportion to the depth than in *sordida;* margins of the lobes in general as in *sordida* but the ventro-cephalic angle is distinctly strumose. Tegmina surpassing the femoral apices by about two-thirds of the length of the pronotal disk, relatively broad, the

[3] Trans. Amer. Entom. Soc., xlii, p. 290, (1916).

greatest width contained slightly less than five times in the greatest length of the same: margins as a whole as in *sordida* but the distal margin is less strongly oblique truncate. Wings proportionately broader than in *sordida*, the greatest width contained twice in the greatest length of the same; anterior field relatively broad and with its distal margin slightly less sharply angulate than in *sordida;* axillary field appreciably broader, its margin more regularly arcuate and in detail more crenulate than in *sordida*. Prosternal spine conical, erect, slightly antrorse: interspace between the mesosternal lobes slightly transverse, regularly widening distad, the caudo-internal angle of the lobes well rounded: metasternal lobes separated by a space equal to about one-half that separating the mesosternal lobes.

Abdomen moderately compressed, the dorsum tectato-carinate longitudinally: ovipositor elongate, much produced, but particularly the dorsal pair, appreciably compressed; dorsal pair of valves in lateral view straight proximad, faintly sigmoid distad, the dorsal surface narrowly excavato-deplanate, the dorsal margins subcarinate and distad faintly crenulato-serrulate, the apex bluntly acute when seen from the side, faintly recurved; ventral pair of valves appreciably shorter than the dorsal valves, very slender, almost straight, the distal section decidedly compressed, the margins unarmed, the apex hardly decurved.

Cephalic coxae with the conspicuously colored section markedly strumose. Cephalic and median limbs relatively short. Caudal femora nearly equal to one-half the body length, moderately compressed, in shape and proportions much as in *sordida:* caudal tibiae proportioned as in *sordida*, pilose, armed on the external margin with six and on the internal margin with seven to eight spines: caudal tarsi as in *sordida*.

*Allotype*.—♂; Same data as the type. [Acad. Nat. Sci. Phila.]

Differing from the description of the type in the features here mentioned. Size relatively small. Head not differing from the description of that portion in the male; antennae three times as long as the dorsum of the pronotum. Pronotum with the greatest width of the disk contained one and one-fourth times in the greatest length of the same: lateral lobes proportionately narrower in relation to the depth than in *sordida*. Tegmina surpassing the apices of the femora by about the length of the pronotal disk, otherwise as in the female. Interspace between the mesosternal lobes sublongitudinal, appreciably constricted briefly cephalad of the middle, regularly and considerably expanding caudad of the same: interspace between the metasternal lobes strongly longitudinal and very narrow. Supra-anal plate of the same form as that found in *C. sordida*, the sigmoid transverse carina at the proximal two-fifths being slightly less prominent than in that species: cerci of the same general type as occurs in *sordida*, but more elongate and attentuate distad, the apex also faintly decurved: subgenital plate similar to that of *sordida*. Caudal femora slightly longer than one-half the body length: caudal tibiae with five to six spines on the external margin and seven to eight spines on the internal margin.

General color of the dorsal and lateral surfaces ranging from dark olive and dusky olive green to dark ivy green, the base color of the tegmina ranging from seal brown to fuscous black, strumose areas on the head, pronotum and pleura zinc orange to yellow ocher.

Eyes uniform tawny, dresden brown or mars brown; antennae blackish, proximad flecked with olive green.

Tegmina with the venation completely outlined in yellow ocher to olive-ocher. Wings infumate with fuscous, the coloration intensified to infuscation distad and around the periphery of the radiate field, the costa and the longitudinal veins heavily pencilled with fuscous, the disk very narrowly and weakly tinted with antimony yellow proximad.

Abdomen with the greater portion of the dorsal surface ranging in shade from orange to yellow ocher, the lateral faces of the abdomen blue black; in the male the yellow dorsal surface is hardly interrupted, the distal margin of the segments laterad, and to a certain degree ventrad, lined with dusky green-blue, the ventral surface of the abdominal segments largely verdegris green, with each segment, excepting the two distal ones, with a triangular figure of dull wax yellow; apex of the abdomen in the male blue black; in the female the yellow of the dorsal surface is broken into broad distal borders of the segments, all of the remainder of the abdomen blue black, the ventral surface occasionally with faint traces of ventral pale markings, ovipositor jaws dull wax yellow.

Cephalic coxae with the strumose area colored similarly to those on the head and thoracic segments. Cephalic and median limbs blue black, the following pattern more decided in the male than in the female and in the latter occasionally subobsolete, femora lined dorsad and ventrad with the pale color which washes the strumosities of the body, tibiae lined ventrad with the same (on cephalic limbs variable), tarsi distinctly lined dorsad. Caudal femora with the external face of the general color, weakly tinted ventro-laterad with hessian brown; ventral and internal surfaces ox-blood red; incomplete pregenicular annulus present only on the ventral and internal faces, internal genicular lobe and ventral portion of the external genicular lobe primuline yellow; longitudinal carinae and portion of the external paginal pattern rather finely lined with olive-yellow to wax yellow: caudal tibiae of the general color: caudal tarsi with an external lining of wax yellow present in the male sex and occasionally to a slight extent in the female as well.

*Measurements (in millimeters)*

| | Length of body | Length of pronotum | Greatest caudal width of pronotal disk | Length of tegmen | Length of caudal femur |
|---|---|---|---|---|---|
| ♂ | | | | | |
| Rio Mato, Venezuela, *allotype* | 26 | 4.4 | 3.6 | 21.7 | 14.2 |
| Rio Mato, Venezuela, *paratype* | 25.5 | 4.6 | 3.5 | 21 | 13.5 |
| ♀ | | | | | |
| Rio Mato, Venezuela, *type* | 34 | 6.4 | 5 | 28.8 | 18.3 |
| Rio Mato, Venezuela, *paratype* | 35 | 6.5 | 5 | 27.6 | 17.3 |

In addition to the type and allotypes we have before us seven paratypes specimens (two males and five females) bearing the same data as the type. These specimens show no noteworthy features of difference from the descriptions of the type and allotype here given, excepting in the general tone of the coloration and its main features, which variation has been adequately discussed above, and in the number of spines on the margins of the caudal tibiae. The latter we find varies on the external margin from four to six, and on the internal margin from seven to eight.

**Leiotettix mendosensis** new species (Pl. XVIII, figs. 12, 13 and 14.)

A striking new species allied to *L. sanguineus* Bruner and *politus, pulcher* and *hastatus* Rehn, all forms from Paraguay and the northern portion of Argentina. From all these species the new form differs in the broad, blade-like, hooked and inwardly directed distal half of the male cercus. The new *mendosensis* also differs from *hastatus* in the somewhat shorter subgenital plate of the male, the more slender general form, the narrower vertex and fastigium, the more pronounced median carina of the pronotum and the more finely angulate caudal margin of the pronotal disk, as well as the more slender caudal femora; from *politus* in the broader vertex, more impressed fastigium and narrower and uniformly impresso-sulcate frontal costa; from *sanguineus* in the same features and also in the reddish caudal tibiae and from *pulcher* in the more slender form, more longitudinal pronotum, which has the median carina somewhat more pronounced, and in the less bullate head.

*Type.*—♂; San Ignacio, Province of Mendoza, Argentina. Elevation 1235 meters. March 15, 1908. (P. Jorgensen.) [Acad. Nat. Sci. Phila., Type no. 5293.]

Size medium; form slender, compressed.

Head with the dorsal length subequal to three-fourths the dorsal length of the pronotum; occiput gently arcuate when seen from the side, decurving regularly cephalad to the fastigio-facial angle, interspace between the eyes faintly broader than the interantennal width of the frontal costa; fastigium slightly broader than the interocular space, rather shallowly but broadly and distinctly excavate, lateral margins delicate, carinulate, the excavation of the fastigium separated from the frontal costa by a transverse obtuse-angulate carinulation; fastigio-facial angle rounded obtuse when seen from the side,

face rather strongly and regularly retreating; frontal costa at the dorsal angle faintly more than one-half as wide as the interocular space, the margins expanding thence to the inter-antennal section, which is half again as wide as the fastigio-facial angle, ventrad faintly narrowed, then faintly and gradually expanding to the clypeal suture, surface of the costa punctato-excavate dorsad, distinctly excavate and sulcate ventrad of the interantennal regions, margins carinate; supplementary facial carinae moderately sinuate, diverging ventrad: eyes moderately prominent when seen from the dorsum, in basal outline broad ovate, their depth nearly twice that of the infra-ocular sulcus: antennae slightly less than one and one-third times as long as the dorsum of the head and pronotum together, weakly depressed.

Pronotum elongate, dorsal length slightly more than one and one-half times the greatest width of the dorsum, not sellate when seen from the side, the dorsal line nearly straight in profile; cephalic margin of disk subtruncate, caudal margin of same obtuse-angulate with the angle rather narrowly rounded, lateral angles of the disk rounded, subparallel; median carina distinct, prozona forming slightly more than one-half the length of the dorsum of the pronotum, metazona ruguloso-punctulate; transverse sulci distinct, the caudal one alone severing the median carina: lateral lobes about one-fourth longer than the greatest depth of the lobes; cephalic margin of lobes slightly oblique truncate, ventro-cephalic angle broadly rounded obtuse, ventral margin broad obtuse-angulate with the median angle rounded, ventro-caudal angle broadly rounded, nearly rectangulate, caudal margin sinuato-truncate. Tegmina surpassing the apices of the caudal femora by one-half the dorsal length of the pronotum, narrow, subequal, apex rounded. Wings reaching to the apices of the tegmina. Prosternal spine prominent, erect, conical; interspace between the mesosternal lobes distinctly longitudinal, its least width equal to less than one-half the length of the interspace, internal border of the mesosternal lobes arcuate, meso-caudal angles of same rounded rectangulate: metasternal lobes attingent.

Furcula developed as brief, attingent, simple fingers, which are no more than one-sixth of the length of the supra-anal plate: supra-anal plate in general trigonal, the lateral margins parallel in the proximal two-fifths, thence straight convergent to the apical fifth, where the margin is broadly obtuse-angulate; in the medio-longitudinal section the plate is moderately elevated, in the proximal half this is distinctly sulcate, narrowing distad, while immediately proximad of the apex of the plate there is a slight median impression, laterad of the median elevated area the plate is longitudinally and convergingly concave: cerci about one and one-third times as long as the supra-anal plate, moderately compressed proximad, strongly compressed distad; proximad, when seen from the side, tapering from the broad base to the very narrow middle, distal half sharply angulate inwards at an angle of forty-five degrees to the proximal half, in side view very broad subfalciform, the dorsal margin strongly arcuate, convex, ventral margin gently concave, the tip acute: subgenital plate produced, elongate, scoop-shaped, regularly narrowing when seen from the dorsum, the apex rounded, when seen from the side the margin is moderately sigmoid, weakly cingulate proximad.

Cephalic and median limbs of average development. Caudal femora two and one-half times as long as the pronotal disk, with the greatest depth contained three and one-half times in the greatest length of the same: caudal tibiae falling short of the femoral length by about the length of the metazona of the pronotum, armed on the external margins with seven to eight spines, on the internal margins with eight to nine spines.

General color very dull aniline yellow, approaching orange-citrine on the dorsum of the pronotum, the limbs touched with citrine, the apex of the abdomen weakly light cadmium; fastigium and face caudad to the infra-ocular sulcus, clove brown. The broad postocular bars, which take up one-half the depth of the lateral lobes of the pronotum, are continued to and over the dorsal portion of the pleura, shining blackish brown. Eyes dark chestnut; antennae pinkish cinnamon proximad, passing to tawny-olive distad, the apex infuscate. Tegmina with discoidal field bearing a gradually weakening continuation of the postocular bars, chiefly formed by lining of the venation. A second blackish brown irregular line is indicated on the mesopleura dorso-cephalad of the median coxal insertion, and on the metapleura dorso-cephalad of the caudal coxal insertion. Caudal femora with the genicular arches blackish brown, the dorsal surface of the interlobal section clove brown; caudal tibiae passing from ochraceous-salmon proximad to coral red distad, spines antimony yellow, black tipped. Caudal tarsi ochraceous-buff, dorsum of metatarsi washed with pale coral red.

Length of body, 20.2 mm.; length of pronotum, 4; greatest dorsal width of pronotal disk, 2.5; length of tegmen, 16; length of caudal femur, 10.5.

The type is unique.

**Dichroplus forcipatus** new species[4] (Pl. XVIII, fig. 15.)

Closely allied to *D. brasiliensis* (pl. XVIII, fig. 16), but differing in the slightly longer tegmina and wings, the obsolete or at least subobsolete character of the usual dark lateral bars and the complete elimination of the generally marked pale dorso-lateral bars of *brasiliensis*, in the less squarely truncate distal margin of the caudal genicular lobes, in the much duller color contrasts of the caudal femora and tibiae, in the more delicately conical prosternal spine, in the male supra-anal plate having the distal portion very

[4] Several years ago the author recorded (Proc. Acad. Nat. Sci. Phila., 1913, p. 345, (1913)) a single male specimen of the genus *Dichroplus* from the territory of Misiones, Argentina, as *D. brasiliensis*, the latter a species very briefly characterized in its original description, where no mention was made of the genitalic characters of the male. At that time females of true *brasiliensis* were at hand, but no males, and with these females the Misiones male agreed quite well. Since that date, however, we have received a series of both sexes of *brasiliensis* and a few additional specimens of both sexes of the Misiones form and we find them to be distinct, differing most strikingly in the form of the male cerci.

broadly obtuse-angulate, instead of the whole plate acute trigonal, in the male cerci being simple, slender distad and incurved, instead of compressed distad and directed caudad with the form sigmoid when seen from above, and in the slightly more produced male subgenital plate. Giglio-Tos' *D. distinguendus*, described from San Pedro Province, Paraguay,[5] may be closely related to this species, not having been recognized by us in the material we have studied, but from the diagnosis it apparently differs from *forcipatus* in having the frontal costa entirely obtuse sulcate, in its greater size, its proportionately shorter tegmina, its brown-greenish caudal tibiae and other details of the coloration.

*Type.*—♂; Misiones, Argentina. December 14, 1910. (P. Jorgensen.) [Acad. Nat. Sci. Phila., Type no. 5292.]

Size medium: form relatively slender: surface dull.

Occiput strongly arcuate when seen from the side, rather strongly declivent to the fastigium, which has the same angle; interocular width faintly less than interantennal width of frontal costa: fastigium with greatest width of its disk faintly greater than the interocular width of the vertex, very shallowly excavate, margins distinct but not high; fastigio-facial angle broadly rounded when seen from the side, appreciably produced, extending cephalad of the eye a distance equal to one-half the width of the latter: facial line distinctly retreating: frontal costa narrowing to the fastigio-facial junction, expanding moderately between the antennal bases, slightly narrowed ventrad of the median ocellus, gently diverging ventrad of this, subobsolete at the clypeal suture, dorsal section of costa punctato-excavate, about and ventrad of the median ocellus for about two-thirds of the distance between the ocellus and the clypeal suture moderately and broadly sulcate, ventral section non-sulcate: supplementary facial carinae distinct, sinuate, but slightly diverging ventrad: eyes moderately prominent when seen from the dorsum, in basal outline subovate, distinctly flattened cephalad, their greatest depth nearly twice as great as the length of the infra-ocular sulcus: antennae twice as long as the dorsum of the pronotum, subdepressed.

Pronotum with the greatest dorsal length two-fifths of the length of the caudal femora, in form but very faintly sellate when seen from the side: disk of pronotum with greatest (caudal) width of disk contained slightly more than one and two-fifths in the greatest length of the same: cephalic margin of disk subtruncate with a very faint median emargination; caudal margin of disk obtuse sub-rectangulate, with apex of angle narrowly rounded and margins decidedly cingulate: median carina obsolete on the prozona and cephalic third of metazona, distinct but low on the caudal two-thirds of the metazona; prozona and metazona subequal in length; transverse sulci distinct, narrow: lateral lobes of the pronotum with the greatest dorsal length one-third greater

[5] Bollett. Mus. Zool. Anat. Comp. Torino, ix, no. 184, p. 22, (1894).

than the greatest depth of the same; cephalic margin of lobes sinuato-subtruncate, ventro-cephalic angle obtuse, narrowly rounded, ventral margin obtuse-angulate, cephalic section weakly concave, ventro-caudal angle rounded obtuse, caudal margin oblique subtruncate. Tegmina projecting distad of the apices of the caudal femora a distance equal to two-thirds of the length of the pronotum; apex rounded subangulate; venation coarse, subelevated. Wings reaching to tegminal apices. Prosternal spine erect, conical, acute; interspace between the mesosternal lobes longitudinal, its least width equal to twice the length of the same, broadening caudad, meso-caudal angles of the lobes rounded rectangulate; metasternal lobes narrowly attingent.

Furcula very brief, subattingent, faintly divergent, narrow, rounded fingers; supra-anal plate short linguiform, lateral margins in general arcuate convergent to the obtusely rounded apex, the margin slightly indented at the proximal fourth; surface of the plate with a median, deeply excavate area on proximal half, this narrowing distad and with distinct subelevated margins, distal half of median section of surface of plate weakly elevated and with slight, lateral, parallel shoulders, extensive lateral sections of the surface of the plate distinctly concave; cerci extending caudad to the apex of the supra-anal plate, in general form substyliform, tapering from a relatively broad base to a slender distal section, which is approximately one-third as deep as the base of the cercus, and very faintly spatulate, the apex very bluntly rounded; when seen from the dorsum the cerci are regularly inbowed and as a pair forcipate; subgenital plate greatly produced, weakly impressed, attenuate when seen from the dorsum, faintly bulbose and rounded at apex, when seen from the side the margin of the plate is very weakly arcuate, the apex distinctly shallower than the base; pallium weakly erected.

Cephalic and median limbs with femora moderately inflated, tibiae proportionately slender. Caudal femora relatively slender, narrowing distad, the greatest depth contained three and one-half times in the greatest length of the same, usual bullation of the proximal portion not strongly indicated, subcompressed, pagina deeply engraved; caudal tibiae slightly shorter than the femora, armed on external margin with nine spines, on internal margin with ten to twelve spines.

*Allotype.*— ♀ ; Misiones, Argentina. December, 1910. (P. Jorgensen.) [Academy of Natural Sciences of Philadelphia.]

Differing from the above description of the type in the following details. Size rather above average; form relatively robust.

Occiput, interocular space and fastigium less strongly arcuate, the latter evenly and not strongly arcuate declivent; interocular width faintly greater than the interantennal width of the frontal costa; fastigium with its greatest width subequal to its greatest length, hardly excavate; facial line less decidedly retreating and more vertical, the fastigio-facial angle projecting cephalad of eye a distance equal to more than one-half the width of the eye; frontal costa regularly and faintly narrowing dorsad in dorsal section, otherwise as in male, the sulcation less extensive and decided; supplementary facial carinae more distinctly diverging ventrad than in the male; eyes little prominent when

viewed from the dorsum, in basal outline subreniform-ovate, flattened cephalad, their greatest depth nearly one and one-half times the length of the infraocular sulcus: antennae one and three-fourths times as long as the dorsum of the pronotum, not as strongly depressed as in the male.

Pronotum nearly plane dorsad: cephalic margin of disk truncate, caudal margin of disk very faintly more rectangulate than in the male, the margins distinctly sinuate: median carina obsolete on the prozona, distinct but low on the metazona: lateral lobes of pronotum with the greatest depth faintly greater than the greatest dorsal length. Tegmina projecting caudad of the apices of the caudal femora a distance equal to one-half the dorsal length of the pronotum, apex more rounded than in the male. Interspace between the mesosternal lobes subquadrate, slightly narrower than the width of one of the lobes, the latter squared with the angles narrowly rounded: interspace between the metasternal lobes narrow.

Ovipositor jaws compressed, produced, strongly arcuate and attenuate distad.

Cephalic and median femora not inflated.

General color ranging from tawny to mummy brown, occasionally (in type and allotype) with dorsal surface of head and pronotum distinctly washed with fuscous, decided postocular bars of blackish occasionally (in type alone) present on the prozona of the lateral lobes of the pronotum and also weakly indicated on the metazona of the same. Tegmina obscurely blotched to a variable degree with small areas of fuscous, occasionally these are absent (♂ paratype): antennae antimony yellow, becoming buckthorn brown distad. Caudal femora with dorsal surface obscurely trimaculate with fuscous, occasionally these are absent (♂ paratype): ventral and internal surfaces of the caudal femora dull carmine to acajou red in the male, mottled light brownish olive to mottled chactura black in the female: external face of the caudal femora always paler than the general color, occasionally (♂ paratype) washed with pale rainette green: ventro-lateral carinae of caudal femora distinctly ticked with the light and dark tones of the coloration: caudal tibiae ranging from dull vinaceous-gray to vinaceous-slate, the spines cream-buff, with the tips black.

The paratypic male represents a recessive phase of the coloration with almost no dark markings, the type and allotype represent the strongly intensive condition.

*Measurements (in millimeters)*

| | Length of body | Length of pronotum | Greatest dorsal width of pronotum | Length of tegmen | Length of caudal femur |
|---|---|---|---|---|---|
| ♂ *type* | 19.4 | 4.2 | 2.8 | 16.4 | 10.5 |
| ♂ *paratype* | 18.4 | 4.4 | 3 | 15 | 11 |
| ♀ *allotype* | 26.8 | 6.4 | 4.2 | 21 | 15 |
| ♀ *paratype* | 27.6 | 5.9 | 4.2 | 20.5 | 14.5 |

In addition to the type and allotype we have before us a male and a female paratype, both from the Misiones and collected by Jorgensen, the former taken April 10, 1910, the latter in December, 1910. Aside from the color features mentioned in the description no noteworthy differences are apparent, except that the paratypic male has but eight spines on the external margin of the caudal tibiae.

**Eurotettix schrottkyi** new species (Pl. XVIII, figs. 17, 18 and 19.)

Near to *E. robustus* Bruner,[6] from Chapada, Matto Grosso, Brazil, but differing in the more ovoid tegmina of the male, the more slender caudal femora and the striking coloration, the sutural half of the male tegmina and ventral section of the lateral face of the caudal femora of both sexes being solidly yellow, in strong contrast to the general color.

*Type.*—♂; Puerto Cantera, Paraguay. January. (C. Schrottky; no. 14.) [Academy of Natural Sciences of Philadelphia, Type no. 5232.]

Size medium: form robust: surface dull or very weakly glabrous on the sides and venter of the abdomen, venter of the thorax and on the greater part of the limbs.

Head with the occiput moderately arcuate, regularly declivent over the interocular section and the fastigium; interocular width of the vertex subequal to the width of the frontal costa at the median ocellus: fastigium moderately longitudinal, its greatest length one and one-half times its greatest width, very shallowly but broadly excavate, margins distinct but low; fastigio-facial angle rounded when seen from the side; interantennal section of face very faintly produced, ventral section of face moderately retreating: frontal costa slightly narrowed at the fastigio-facial angle, weakly expanding to the interantennal region, subequal thence to the median ocellus, weakly expanding thence ventrad and subobsolete a short distance dorsad of the clypeal suture; dorsal section of costa punctato-sulcate, sulcate a very short distance dorsad and a greater distance ventrad of the ocellus, margins thick and not defined; supplementary facial carinae moderately divergent ventrad: eyes when seen from the dorsum moderately prominent, in basal outline broad ovate, markedly flattened cephalad and weakly so ventrad, forming an appreciable obtuse ventro-cephalic angle, in depth the eye is equal to one and one-half times the length of the infra-ocular sulcus: antennae missing.

Pronotum with greatest caudal width of disk contained one and one-half times in the greatest length of the same, the dorsal surface arcuate in transverse section, rounding into the lateral lobes without a distinct angle: cephalic margin of disk gently arcuate with a broad though relatively shallow, median

[6] Ann. Carneg. Mus., viii, p. 135.

V-shaped emargination; caudal margin of disk broad obtuse-angulate with the angle broadly rounded, the margins laterad faintly emarginate and as a whole narrowly cingulate: median carina not indicated on the prozona, faintly marked on the metazona; prozona occupying about three-fifths of the dorsum of the pronotum; transverse sulci complete, finely impressed: lateral lobes of the pronotum with greatest depth contained one and one-third times in the greatest dorsal length of the same; cephalic margin of the lobes moderately oblique sub-truncate, ventro-caudal angle obtuse, ventral margin broadly obtuse-angulate, the median angle of same rounded, cephalic section weakly concave, ventro-caudal angle rounded, caudal margin oblique truncate; sulci deeply impressed on the lateral lobes. Tegmina coriaceous, with close network of veins, the general longitudinal veins evident, abbreviate, falling slightly short of the distal margin of the proximal abdominal segment, narrowly non-attingent mesad, faintly shorter than the disk of the pronotum, short lanceolate elliptical in form, the greatest width contained one and seven-tenths in the greatest length of the same: costal margin strongly arcuate except in the proximal section, where it is nearly straight, sutural margin moderately arcuate, apex narrowly rounded rectangulate. Wings rudimentary. Prosternal spine conical, apex blunted, slightly retrorse in general direction: interspace between the mesosternal lobes faintly longitudinal, strongly widening caudad, the lobes obliquely truncate, with meso-caudal angle obtuse: metasternal lobes very narrowly separated.

Abdomen moderately compressed proximad, apex moderately elevated, non-clavate: furcula minute, attingent, very short and blunt fingers: supra-anal plate trigonal, the proximal breadth slightly greater than the median length, margins sinuato-convergent, the apical section blunter, obtuse-subrectangulate, the immediate apex rounded; surface of the plate elevated mediolongitudinally, the distal section more ampliate, proximad there is indicated for about one-third of the length of the plate a deep, rounded sulcus, the vicinity of which is roughened and haired, laterad the surface of the plate is broadly, rather deeply and regularly concave: cerci short, not reaching to the apex of the supra-anal plate, in general form falciform, very broad and compressed at base, regularly narrowing to the distal third, which is relatively slender—that is one-fourth as broad as the base—upcurved and with the apex blunt; when seen from the dorsum the cerci are straight in the proximal two-thirds, rather sharply though obtusely incurved at distal third, straight oblique thence distad: subgenital plate moderately elongate, conical, acuminate, dorsal margins straight when seen from the side, ventro-distal line in profile regularly straight ascendant, viewed from the dorsum the margins converge regularly to the relatively narrowly rounded apex: pallium slightly elevated proximad.

Cephalic and median femora considerably inflated: caudal femora two and one-half times as long as the dorsum of the pronotum, subcompressed, moderately slender, greatest depth contained four times in the greatest length; external paginae regularly sculptured, geniculär lobes broadly rounded: caudal tibiae slightly shorter than the caudal femora, armed on the external margin

with nine, on the internal margin with ten spines, internal distal spurs subequal in length, external distal spurs distinctly shorter than the internal, subequal in length to one another.

*Allotype.*— ♀ ; Same data as type. [Acad. Nat. Sci. Phila.]

Differing from the description of the male in the following features.

Fastigium when seen from the side more arcuate, the fastigio-facial angle more broadly rounded and less prominent than in the male; fastigium slightly broader, even more shallowly excavate, margins subobsolete; inter-antennal section of the frontal costa slightly less produced when seen from the side; frontal costa of the general form found in the male but broader, with the sulcation rather shallower; eyes somewhat less prominent than in the male, in basal outline slightly less broadly ovate than in the male, in depth equal to one and one-fourth times the length of the infra-ocular sulcus; antennae in length subequal to the length of the head and dorsum of the pronotum combined, slender.

Pronotum with disk one and one-third times as long as greatest width, median carina subobsolete on the metazona, entirely obsolete on the prozona; prozona of disk very slightly longer than the metazona of the same; median angle of the ventral margin of the lobes of the pronotum not rounded. Tegmina of similar length, but distinctly broader, being broad ovate in outline, greatest breadth contained one and one-fifth times in the greatest length, apex broadly rounded obtuse; sutural margins narrowly overlapping. Interspace between the mesosternal lobes transverse, its width subequal to that of one of the lobes, interspace regularly enlarging caudad, meso-caudal angle of lobes obtusely rounded; interspace between metasternal lobes moderately transverse.

Ovipositor jaws moderately elongate, subcompressed, dorsal valves with dorso-external margins moderately denticulate.

Cephalic and median femora almost uninflated.

General color of head, pronotum and pleura brussels brown (allotype) to mummy brown (type).

Head in female unicolorous; in male with the occiput and postocular region washed with fuscous, the ventral section of the genae, face and (weakly) the mouth-parts washed with carmine (type) to garnet brown (paratype); eyes buckthorn brown to bay; antennae (lacking in male) washed with hay's russet.

Tegmina of male with costal half blackish brown, occasionally (type) weakened to raw umber in portions of the marginal field; sutural half of male tegmina deep chrome to mustard yellow, the two sections sharply divided; tegmina of female uniformly of the general color.

Abdomen of both sexes with the proximal section shining blackish brown laterad; dorsum of abdomen of the general color in the male, with paired naples yellow dots indicated on the second, third, fourth and fifth segments with greater or less distinction; distal portion of abdomen of male largely brownish olive dorsad; of the female of the general color; venter of abdomen of male

bay, paling to burnt sienna; venter of thorax and abdomen of female in general sepia; venter of thorax of male ranging from the ventral color of abdomen of that sex to blue black.

Limbs of male blue black, the dorsal surface of the caudal femora washed with the general color, external face of caudal femora with a sharply defined, longitudinal, ventro-proximal dash of deep chrome. Cephalic and median limbs of female of the general color, blue black on the caudal faces; caudal limbs of the female as in the male, except that the solid blue black and dorsal paler area are broken up by stipplings of light on dark and vice versa, the pagina pattern outlined with the general color and the genicular portion of femora and tibiae much more punctulate, yellow bar on external pagina of femora apricot yellow.

*Measurements (in millimeters)*

| | Length of body | Length of pronotum | Greatest width of pronotum | Length of tegmen | Greatest width of tegmen | Length of caudal femur |
|---|---|---|---|---|---|---|
| ♂, *type* | 18.5[7] | 4.8 | 3.1 | 4.1 | 2.4 | 12.3 |
| ♂, *paratype* | 19.8[7] | 4.5 | 3.2 | 4.2 | 2.6 | 11.8 |
| ♀, *allotype* | 23.7[8] | 6.2 | 4.9 | 5.5 | 4.8 | 16 |

In addition to the type and allotype we have a male paratype, bearing the same data as the type. This specimen was taken in coitu with the allotype, and would have been selected as the type but it was considerably more imperfect than the detached male, which was so indicated. These specimens show no important differences other than those which have been mentioned. In the male paratype one caudal tibia shows ten instead of the more usual nine spines.

We take pleasure in dedicating the species to the well-known South American entomologist C. Schrottky, who kindly sent us the material here described.

## TETTIGONIIDAE

**Paraphidnia lankesteri** new species (Pl. XVIII, figs. 20, 21, 22 and 23.)

Allied to *P. verrucosa* (Brunner),[9] from Brazil, but differing in the more recurved spiniform character of the process springing from the dorsum of the fastigium, in the more elongate pronotum,

[7] The abdomen of the type is slightly more reflexed than in the male paratype.

[8] Abdomen distorted.

[9] Monogr. der Phaneropt., p. 153, (1878).

the four distinct spines on the dorsum of the same, in the deeply sculptured lateral lobes of the pronotum and in the proportionately more elongate caudal limbs.

*Type.*—♂; Cachi, Costa Rica. Elevation, 3500 feet. January, 1914. (C. H. Lankester.) [Academy of Natural Sciences of Philadelphia, Type no. 5348.]

Size medium: form of the usual bizarre type found in this genus, subcompressed: surface in general rugulose, the abdomen smoother than elsewhere, tegmina and exposed portion of wings lichenose-verrucose.

Head well seated in the pronotum, short, broad, deep, subdeplanate cephalad, greatest depth (including mandibles) slightly greater than the greatest width across eyes; when seen from the side occiput gently arcuate: fastigium elongate, elevated, directed cephalo-dorsad, broad proximad, much compressed mesad and distad, in lateral view narrowing distad, the distal fourth decurved at an obtuse angle, apex bluntly rounded; fastigium of vertex separated from the fastigium of the face by an area containing dorsad the paired, moderately bulbous, dorsal ocelli, and ventrad a pair of brief, finger-like, attingent processes; fastigium of face broad, blunt, rounded, containing the large, moderately convex ocellus: face faintly transverse, distinctly wrinkled with small transverse wrinkles, in profile strongly sinuate and bullate ventrad: clypeus with its surface developed into a pair of rounded tubercles: genae with a distinctly elevated, but rounded, tubercle briefly dorsad of the ventro-caudal angle, cephalad of this the genae are subexcavate, infra-ocular groove markedly sinuate: eyes strongly prominent and globose when seen from the dorsum, in basal outline ovato-circular, the axis ventro-cephalic to dorso-caudal in direction, the greatest depth of the eye faintly greater than the depth of the infra-ocular portion of the genae: antennae slightly surpassing the apex of the abdomen; proximal and second joints each with a decided digitiform knob on the internal face, that on the second joint the larger; joints each thickened and enlarged distad, this tendency subobsolete toward the apex of the antennae, in addition we find four areas, regularly placed, where from two to four segments are considerably enlarged on the dorsal and lateral surfaces, and covered to a greater or lesser extent with short, stiff bristles, which are absent from the ventral surface.

Pronotum deeply sculptured and quadrispinose selliform: disk subequal in proportions; cephalic margin broadly obtuse-angulate emarginate, the margin moderately convex laterad; caudal margin more deeply and more nearly V-emarginate, this dividing the margin into two subarcuate lobes, the margin cingulate; at cephalic third the disk bears a very deeply impressed, trough-like, transverse impression, which as deeply severs the lateral angles of the disk, another similar but very much more shallow one is indicated, but broken mesad, at the caudal third: lateral angles with a low, compressed tubercle at the cephalic margin, a far larger, conical, acute, obliquely divergent, spiniform tubercle is placed between the first and second transverse impressions and caudad of the latter a shorter, more longitudinal and blunter, but generally

similar, tubercle is placed; median carina represented by small, paired, attingent folds at several points, obsolete cephalad and caudad: lateral lobes with greatest dorsal length subequal to greatest depth, the latter being between the median spine of the lateral angle and the ventro-caudal angle of the margin of the lobe, the lobe much shallower cephalad; cephalic margin of the lobes with a weak obtuse-angulate emargination cephalad, the margin convex ventrad of this, ventro-cephalic angle broadly rounded, ventral margin sinuate, particularly over the cephalic coxa, ventro-caudal angle broadly rounded rectangulate, caudal margin very gently arcuate, moderately oblique, humeral sinus acute, deep, slightly curved; surface of lateral lobes folded and bullate, with the sulci deeply incised, the intervening areas inflated and welt-like, a distinct median spine and a large, elongate reniform, bullation caudad of the same especially indicated. Tegmina nearly twice as long as the body, far surpassing the apex of the caudal femora, coriaceous-reticulate in texture, the surface lichenose-verrucose, the transverse nervures and distad the longitudinal veins appreciably thickened and elevated; greatest width of the costal and discoidal fields contained over five times in the greatest length of the tegmina, the distal section appreciably upcurved, the apex rectangulate costad; costal margin arcuate proximad and distad, straight mesad; sutural margin very gently concave in the distal portion of its length: median vein diverging at proximal third, furcate: stridulating field moderately longitudinal, its greatest width contained faintly more than twice in the length of the field, free margin arcuate, with a slight obtuse-angulation at the apex of the stridulating vein, the latter short, slightly oblique, thickened. Exposed portion of wings about twice as long as the pronotal disk, apical margin oblique truncate, apex sutural and acute; surface of exposed portion of wings similar to tegmina, covered portion of wings membranous. Prosternum transverse, cephalic margin strongly transverse: mesosternum with the lobes wing-like, much narrowed along the median line, cephalic margin obtuse-angulate concave, caudal margin concave, lateral margins of lobes oblique, subarcuate: mesosternal foveolae well separated, in a common depression which is transverse and in form resembles half a sharp oval bisected longitudinally: metasternum inverted broad trigonal, the cephalic margin straight, lateral margins oblique, strongly converging caudad, faintly arcuate, the lobes very narrow and moderately reflexed: metasternal foveolae contiguous in a common opening, which is quadrate in proportions, in general form trapezoidal.

Abdomen short, plump; medio-dorsal line with a series of rounded, node-like, recurved tubercles, which are well developed on the middle segments and become obsolete on the penultimate segment; lateral aspect of abdomen with a series of strumose, rounded tubercles developed along a line which is slightly dorsad of the middle of the segment, these obsolete distad, also a line of low, indistinct swellings ventrad of the more decided series, free margins of segments sinuate laterad in the vicinity of these bullations; ventro-lateral sections of dorsal tergites rugulose, rather sharply contrasted with the generally smoother dorsal surface; disto-dorsal abdominal segment subarcuate emarginate mesad,

the bottom of the emargination slightly truncated; supra-anal plate moderately transverse, shield-shaped, apex very narrowly acuminate; cerci complex, with a moderately inflated, semi-bulbous base, which bears numerous long hairs placed in sensory pits or craters, this portion short and narrowing regularly; distal section shining, consisting of two parts, one an outer, compressed, lamellate, arcuate, obtuse-angulate (in profile) section, this tapering in width and ending in an acute spine; the other an inner, compressed, elongate, lamellate portion, which is bifid, the extreme tip unguiculate, terminating in a spine, the branch placed ventrad of the main extremity, recurved, slightly curled and armed with four marginal denticulations; the two arms of the distal section of the cercus in contact and apparently immovably so; subgenital plate longitudinal, narrow in proximal two-thirds, slightly widening in distal third, distal margin nearly semicircularly arcuate-emarginate, ventral surface of plate with a low, medio-longitudinal carina and thickened lateral rods, which form the foundations for the attachment of the short, simple, but articulate, styles.

Limbs with surface carinate and substrumose. Cephalic femora short, the dorso-cephalic face with four low, but distinct, rugulose strumosities, of which the two proximal extend to the ventral margin of the femur; ventro-cephalic margin with two spines distad, which are distinctly inflated proximad; ventro-caudal margin unarmed; genicular lobes spined; cephalic tibiae appreciably longer than the femora, with the tympani exposed, large; dorso-cephalic margin with several distinct tubercles. Median femora slightly longer than the cephalic femora; ventro-cephalic margin with three lamellate spines, the distal the larger; ventro-caudal margin unarmed; genicular lobes spiniferous; cephalic face with three groups of low, rugulose strumosities; median tibiae distinctly longer than the femora, ventral margins distinctly spined, dorsal margins with three pairs of recurved spiniform lobes, and in addition two extra similar ones on the dorso-caudal margin. Caudal femora about two and one-fourth times as long as the tegmina, slender, subcompressed, rugulose; ventro-external margin with four lamellate spines, the distal much larger than the others and truly lamellate; internal margin with three spines, the distal relatively large and sublamellate, but distinctly smaller than the external one, the other two spines minute; genicular lobes spiniferous; caudal tibiae distinctly surpassing the femora in length, dorso-external margin with thirteen to fourteen spines of similar character of variable size; ventral margins with nine to ten pairs of short, addressed spines.

General body color bister, touched and pointed with fuscous, and also russety on the occiput and dorsum of the pronotum, the limbs mottled and brokenly annulate with dull antimony yellow, which is often further contrasted by blackish fuscous pencillings. Eyes saccardo's umber; antennae numerously but obscurely annulate russet and yellowish, the nodes darkened and with the bristles on them blackish fuscous. Abdomen with its dorsal surface much darkened with fuscous, the median lobules russety, spine-like portion of cerci black-tipped, styles greenish. Annulate type of coloration apparent only on the median and caudal femora, and there the pale color is between the strumosities, which are much pencilled with blackish fuscous. Tegmina of a

dead-leaf and lichenose type of formation and coloration; proximad being mottled mars brown and buckthorn brown, with numerous veins and nervures pencilled with blackish fuscous; distad more prout's brown, light ochraceous-buff and white, with a distal lichenose patch of pale cendre green. Proximad there is almost no pattern, merely a blending of the tones, the stridulating field having a mere intimation of a jade green wash; distad the pattern is bold and blotchy, large and in general with the parts sharply defined from one another, the blackish fuscous lining of many points deepening the general contrast. Exposed portion of wings similar to apical section of the tegmina.

Length of body, 18.3 mm.; length of pronotal disk, 4.4; greatest (caudal) width of pronotal disk, 4.2; length of tegmen, 34; length of wing distad of tegmen (closed), 8.5; length of caudal femur, 15.

The type of this most interesting species is unique. We take great pleasure in dedicating this very striking form to our friend Mr. C. H. Lankester, who collected the type and kindly placed it in our hands for study.

**Chloroscirtus discocercus** new species (Pl. XIX, figs. 1, 2, 3 and 4.)

A very striking new species which can be readily distinguished from the genotype, *C. forceps* Saussure and Zehntner, with specimens of which it has been compared, by the relatively larger tegmina, which also have the distal section proportionately broader, by the coarser tegminal areolation, the more deeply V-emarginate disto-dorsal abdominal segment of the male, which segment has the lateral projections of the plate developed into lamellate processes, by the male cerci bearing on the ventral surface, at the same point as the large tooth found in *C. forceps*, a semicircular lamellate structure, by the male subgenital plate being more produced and narrower than in *forceps*, with the median emargination of the same much less extensive and the lateral sections surrounding this less arcuate and tapering in width distad to the styles.

*Type.*—♂; Cachi, Costa Rica. Elevation, 3500 feet. (C. H. Lankester.) [Academy of Natural Sciences of Philadelphia, Type no. 5349.]

Size rather large: form as usual in the genus—that of a typical, relatively elongate phaneropterid: surface somewhat shining.

Head with occiput moderately declivent to the fastigium, faintly convex, when seen from the dorsum regularly narrowing to the antennal scrobes; fastigium when seen from the dorsum broad at base, regularly narrowing to its middle, thence narrow and subequal distad to the narrowly rounded apex,

with a distinct medio-longitudinal sulcus, the latter becoming obsolete proximad, the margins somewhat inflated; lateral ocelli large, occupying the lateral faces of the broader proximal section of the fastigium, when seen from the side the apex of the fastigium of the vertex is acuminate, falling slightly short of the apex of the fastigium of the face, not touching the same; fastigium of the face acute, apex very narrowly rounded; median ocellus subelliptical: face moderately inflated transversely when seen from the dorsum, but weakly arcuate when seen in profile; infra-ocular impression elongate, well indicated: eyes but little prominent when seen from the dorsum, axis of eye extending from dorso-caudad to ventro-cephalad, outline of base of eye subovate, moderately exserted cephalad; greatest length of eye (along axis) slightly greater than the greatest length of the infra-ocular impression: antennae distinctly surpassing the extremities of the tegmina, filiform.

Pronotum with dorsum plane, lateral angles of same distinct, continuous, nearly straight, faintly diverging caudad, lateral lobes vertical: dorsum of pronotum with greatest caudal width contained one and two-fifths times in the greatest length; cephalic margin of disk broadly but not decidedly arcuate-emarginate; caudal margin of disk strongly and regularly arcuate; surface of disk weakly ruguloso-punctulate, a delicate but distinct median carina present caudad, a distinct transverse impression present briefly caudad of the middle: lateral lobes slightly deeper than the greatest dorsal width; cephalic margin of the lobes straight except for a short obliquity dorsad, ventro-cephalic angle rounded obtuse-angulate, ventral margin oblique, arcuato-truncate, ventro-caudal angle broadly rounded, caudal margin moderately arcuate, somewhat flattened mesad, humeral sinus deep, moderately acute, bottom of sinus rounded. Tegmina elongate, sublanceolate, subequal in width, greatest width contained nearly five times in the greatest length, in general form faintly sigmoid: costal margin regularly but gently arcuate; sutural margin faintly sigmoid; distal extremity narrowly rounded: marginal field broad, at proximal fourth nearly equal to one-half the width of the entire tegmen, coarsely and openly reticulate; discoidal field similarly but more finely reticulate: median vein diverging at two-fifths of the distance from the base, bifurcate slightly before the middle; ulnar vein straight except for a brief arcuation where it joins the sutural margin; transverse nervures regularly and strongly indicated: stridulating field entirely net-reticulate proximad of the stridulating vein, similar but with a more pronounced longitudinal tendency distad of the same; stridulating vein strongly arcuate, slightly oblique, broad, flattened. Wings projecting distad of the closed tegmina a distance but slightly less than the length of the pronotal disk, acute: expanded wings with the greatest width of one of the wings contained two and one-quarter times in the greatest length of the same. Mesosternum weakly concave cephalad, mesosternal lobes subparallel laterad, caudal margin of segment rectangulate emarginate, the lobes thus acute and strongly and abruptly deflexed from the general sternal plane: metasternum with cephalic margin subtruncate, latero-cephalic angles rounded subtuberculate, lobes arcuate laterad and regularly converging, sharply and abruptly deflexed.

Disto-dorsal abdominal segment produced, strongly arcuate in transverse section, the distal margin deeply divided by a V-emargination into two subvertical, compressed lamellate lobes, which in general narrow distad, are arcuate ventrad with the apex rotundato-rectangulate, the dorso-internal margin of the lobes slightly thickened and sinuate, a distinct impression mesad on the main dorsal section of the segment: supra-anal plate relatively small, elongate, linguiform: cerci elongate, slender, tapering, arcuate, the convexity ventrad, gently inbowed, the extremity slightly thickened, subdepressed, the apex internal in position, acute, chitinous and with two separate, small, recurved teeth on the ventral surface; at the base of this distal thickening on the ventral surface is placed transversely a lamellate disk-like structure, which has its periphery approximately semicircular, but which is only basally attached externally, internally the peripheral margin being carried by the acute, curved, free portion of the lamellation; surface of the lamellation with concentric radiating lines: subgenital plate greatly produced, surpassing the apices of the cerci, from a moderately wide base it narrows, then expands gently, and again narrows distad, the lateral margins sigmoid and formed by the paired thickened rods which extend from the relatively broad base to the styles; distal extremity very narrowly and deeply emarginate, thus causing the disto-lateral portions of the plate to be elongate lobiform; ventral surface of the emargination with a strongly pronounced but delicate medio-longitudinal carina; styles relatively short, narrowly rounded at their distal extremity, faintly arcuate in form, dorso-internal surface deeply concave, ventro-external surface correspondingly convex.

Cephalic femora about five-sixths as long as the disk of the pronotum; cephalic tibiae distinctly surpassing the femora in length, tympani apert on both faces: median femora equal in length to the combined length of the head and pronotum; median tibiae faintly surpassing the femora in length. Caudal femora relatively robust at the base, tapering to the relatively slender distal third; genicular lobes slightly acute, non-spinose; external face of the femora with a weak herring-bone impressed pattern; both ventral margins sparsely spined distad; caudal tibiae surpassing the caudal femora by nearly one-half the dorsal length of the pronotal disk, dorsal surface moderately flattened, ventral section narrowed.

General color between honey yellow and olive ocher, the face nearly as pale as cartridge buff. This shade is probably not the original color, especially on the tegmina, which probably were deep chrysolite green, as a considerable section along the sutural margin and at the apex is of that shade. The limbs are glass green with a brownish tinge. The eyes are mars brown. Pronotum with the lateral angles of the disk chamois color.

Length of body (to apex of disto-dorsal abdominal segment), 21.4 mm.; length of pronotum, 6; greatest (caudal) width of pronotal disk, 4.3; length of tegmen, 37.8; greatest width of tegmen, 8; length of caudal femur, 20.4; length of subgenital plate (exclusive of styles), 6.5.

The type of this remarkable species is unique.

**Anaulacomera alfaroi** new species (Pl. XVIII, figs. 24, 25 and 26.)

Apparently related to *A. maculata* Brunner and *lanceolata* Brunner, both from Bogotá, Colombia, and *A. securifera* Brunner, from central Peru. From all three of these the present species differs in the peculiar form of the male cerci, while from *maculata* it also can be separated by its smaller size and the form of the male anal segment and of the subgenital plate of the same sex; from *lanceolata* by the subequal lateral lobes of the pronotum and the rounded distal margin of the lateral sections of the male subgenital plate; from *securifera* by the more rectangulate, though rounded, insertion of the lateral lobes of the pronotum, the spines on the ventral femoral margins, the form of the male supra-anal plate and the form of the distal margin of the subgenital plate of the same sex.

*Type*.—♂; Orotina, Costa Rica. October 11, 1915. (Anastasio Alfaro.) [Academy of Natural Sciences of Philadelphia, Type no. 5350.]

Size small: form moderately compressed and elongate: surface dull, of limbs more shining, tegmina semitransparent in the areolets.

Head short, transverse, greatest depth of head equal to one and one-third times the greatest width across the eyes: occiput in profile weakly arcuate, gently declivent; fastigium relatively narrow, strongly compressed mesad, slightly broadened distad, the apex when seen from the dorsum truncate, dorsal surface with a distinct but short medio-longitudinal sulcus; facial fastigium not in contact with the fastigium of the vertex, strongly acute in general form, the immediate apex narrowly rounded: facial line very faintly arcuate when seen from the side: palpi very slender and elongate, third joint faintly more than one and one-half times as long as the fourth; fifth joint twice as long as the third, unusually slender, with the extremity moderately but distinctly inflated and thickened: eyes very prominent, subglobose, basal outline of eye nearly circular, greatest depth of eye contained slightly more than one and one-half times in the greatest depth of the infra-ocular portion of the genae: antennae considerably surpassing the tegmina in length.

Pronotum narrow, moderately elongate, the disk subequal, its greatest width (measured caudad) contained faintly more than one and one-half times in the greatest length of the same, deplanate, rounding into the lateral lobes, an angle very faintly intimated cephalad; cephalic margin of disk very broadly obtuse-angulate emarginate, caudal margin of disk broadly arcuate; surface of disk with a finely impressed medio-longitudinal line, also a well indicated, bisigmoid, median, transverse, impressed figure: lateral lobes with greatest depth and greatest dorsal length subequal; cephalic margin of lobes sigmoid, ventrocephalic angle rounded obtuse, ventral margin short, oblique, nearly straight,

ventro-caudal angle very broadly rounded, caudal margin obtuse, gently arcuate, dorsad strongly arcuate to the bottom of the subrectangulate humeral sinus, the dorsal bordering margin of which is gently concave. Tegmina moderately elongate, their greatest width contained slightly more than five times in their greatest length, sublanceolate, the costal and sutural margins in large part subparallel; costal margin very briefly arcuate proximad, distad arcuate to the well-rounded apex, sutural margin rounding to a lesser degree to the apex: neuration areolate, the areolets larger in the marginal field and distad in the discoidal field than proximad in the discoidal field; median vein diverging shortly proximad of the middle of the tegmen, furcate at its middle; ulnar vein reaching the sutural margin at about two-thirds the length of the margin itself; transverse nervures rather regularly placed and forming distinct areas of areolets. Wings, in repose, projecting distad of the apices of the tegmina a distance subequal to the length of the pronotal disk; greatest width of one of the wings contained two and one-third times in the length of the same. Prosternum unarmed.

Disto-dorsal abdominal segment broad, transverse, the distal portion moderately depressed, faintly recurved at the periphery, when seen from the dorsum the margin is broadly arcuate, the arcuation slightly flattened mesad, a medio-longitudinal impression indicated, this deep and pronounced on distal two-fifths, with an appreciable pit at the proximal end of the deep portion, lateral sections of margin of plate considerably arcuate-emarginate over the cercal bases: supra-anal plate prominent, produced caudad of the disto-dorsal abdominal segment a distance equal to two-thirds the length of the latter, the projecting portion developed into a pair of decided, rounded lobes, divided by a deep, rounded, V-shaped emargination, the lateral portions of the paired lobes moderately arcuate expanded and distinctly bent ventrad, median portion of plate depressed proximad; dorsal surface of plate rather thickly covered with short, adpressed, proximad directed bristles, ventral surface with short, regularly placed, recurved and adpressed teeth: cerci in lateral view very broad at base, the ventral margin nearly straight, dorsal margin strongly and regularly descending to the middle of the cercus, proximad the dorsal surface of the cercus bears an obliquely transverse, ledge-like carina, the proximal half of the cercus with numerous long sensory bristles placed in pits or craters; distal section of cercus obliquely depressed, sublamellate, appreciably curled dorso-laterad, the form of the apex rounded acute, the depressed, sublamellate section of the cercus with adpressed teeth like those of the ventral surface of the supra-anal plate: subgenital plate moderately elongate, produced distad in a subquadrate projection, lateral margins of distal three-fifths appreciably but not strongly narrowing distad, distal margin subtruncate with a shallow, median, obtuse-angulation, disto-lateral angles narrowly rounded rectangulate; no styles present.

Limbs slender. Cephalic femora slightly longer than the disk of the pronotum; cephalic tibiae about one and one-half times as long as the cephalic femora, tympanum apert on both faces, the tympanal region appreciably inflated,

portion distad of this proportionately very slender. Median femora about one and one-half times as long as the pronotal disk, appreciably more slender than the cephalic femora; median tibiae slender, tapering, appreciably surpassing the median femora in length. Caudal femora slightly shorter than the body, moderately inflated in proximal half, very slender distad; internal genicular lobes briefly spiniferous, external genicular lobes unspined; ventro-external margin with five to eight spines, ventro-internal margin with one to two spines; caudal tibiae very slender, faintly tapering, subcompressed proximad, surpassing the caudal femora by nearly the length of the pronotal disk.

General color of the head and pronotum light chalcedony yellow, becoming amber yellow on the pleura and abdomen, the apex of the latter veronese green, the dorsum of the pronotum washed with mustard yellow. Tegmina clear hyaline with the venation and reticulation courge green, numerous areolets distad washed with bice green; stridulating field touched with buckthorn brown. Exposed portion of the wings colored similarly to the distal section of the tegmina. Eyes russet touched with chestnut-brown cephalad. Limbs of the general color, tibiae tinted with biscay green to forest green, the latter heavily so distad. Cephalic and caudal femora and disk of pronotum with numerous minute black points of liver brown.

Length of body, 15 mm.; length of pronotum, 3.8; greatest (caudal) width of pronotal disk, 2.3; length of tegmen, 22.8; greatest width of tegmen, 4.2; length of caudal femur, 13.5.

The type of this interesting species is unique. We take great pleasure in dedicating this striking species to Prof. Anastasio Alfaro, Director of the Museo Nacional, San José, Costa Rica, who collected and forwarded to us for study the type of this species, and also numerous other Orthoptera.

**Pycnopalpa aurigera** new species (Pl. XIX, figs. 5 and 6; pl. XX, fig. 3.)

Closely allied to *P. rubiginosa* (Bruner) [*Topana rubiginosa* Bruner],[10] from Chapada, Matto Grosso, Brazil, having the general form of the pronotal structure quite similar, but differing in the fastigium of the vertex being less strongly bicarinate and less distinctly sulcate, in the broader head, the more elongate eye, the less inflated distal palpal joint, the straighter lateral margins of the pronotal disk, in the much less extensive lateral lobes of the same, the proportionately broader marginal field of the tegmina, the distal half of the whole of which is more broadly angulate, in the more acute exposed section of the wings and in the proportionately shorter limbs.

*Type.*— ♀ ; Chanchamayo, Peru. [Academy of Natural Sciences of Philadelphia, Type no. 5352.]

[10] Ann. Carneg. Mus., ix, p. 330, (1915).

Size small: form and surface as usual in this aberrant genus.

Head moderately transverse when seen from the dorsum, the greatest width across the eyes much greater than the medio-longitudinal length of the head, greatest depth of head about one and one-third times the greatest width across the eyes: occiput strongly declivent, weakly arcuate, outlined dorsad by a low, rounded carina, which forms a nearly rectangulate border margining the eyes and antennal scrobes dorsad, the two arms of the border joining at the inter-fastigial suture; fastigium of the vertex rather low, but weakly elevated and gently arcuate in profile, narrowing and compressed distad, a slight medio-longitudinal sulcus indicated dorsad; fastigium of the face not in contact with that of the vertex, broad, semi-globose, not elevated; face with surface moderately cribroso-punctulate, genae smooth; palpi with fourth joint two-thirds as long as third joint, distinctly sigmoid, weakly expanding distad, fifth joint faintly longer than third and fourth joints combined, slender at base, moderately thickened distad, slightly arcuate proximad, extremity rounded: eyes rather prominent when seen from the dorsum, slightly flattened semi-globose; basal outline of eye ovate, narrowed ventrad, depth of eye faintly greater than that of the infra-ocular portion of the genae: antennae incomplete, beyond the enlarged proximal and second joints filiform, brittle.

Pronotum in general sellate, the dorsum deplanate, in profile the dorsum of the pronotum is low cephalad, slightly ascending mesad and deplanate caudad, lateral angles of same pronounced, lateral lobes vertical: dorsum of pronotum with greatest caudal width contained one and one-third times in the greatest length of the same, all margins of same cingulate, the surface velutinous; cephalic margin of disk arcuato-subtruncate, caudal margin broadly arcuate rotundate, lateral margins, though sinuous, diverging caudad, passing without interruption into the caudal, and by a rounded angle into the cephalic, margins, narrowly severed briefly caudad of the latero-cephalic angle; surface of the disk with a faint, imperfectly and incompletely indicated median sulcus, a median V-shaped figure, which is more distinctly indicated than the median sulcus, being placed distinctly cephalad of the longitudinal center of the disk: lateral lobes appreciably longitudinal; greatest depth of the lobes slightly caudad of the middle, the cephalic depth equal to three-fifths of the greatest depth; cephalic margin arcuate-emarginate dorsad and straight mesad and ventrad, ventro-cephalic angle narrowly rounded rectangulate, ventral margin slightly oblique and weakly sinuate cephalad, broadly and evenly arcuate from the middle of the ventral margin to the humeral sinus, the latter narrowly rounded rectangulate; surface of the lateral lobes with a distinct impressed area dorso-caudad. Tegmina of the character found in the other species of the genus, with a proximo-costal and a medio-sutural desiccated area, and scattered similar spots; in length about one and two-thirds times as long as the body with the ovipositor, in general form elongate elliptical-ovate, its greatest width, which is at five-eighths the length from the base, contained slightly more than two and one-half times in its greatest length: costal margin in proximal half oblique (to the tegminal axis), straight, this broadly rounding to the distal section, which is oblique subtruncate toward the apex, gently rounding

distad to the latter, which is rounded slightly acute-angulate, disto-sutural margin oblique truncate, disto-sutural angle broadly rounded obtuse, sutural margin straight in greater part: marginal field equal to slightly less than one-third of the entire tegminal width, subequal in width proximad, attenuate in distal half of tegmen; discoidal field broad, its greatest width at distal fourth of tegmen: mediastine vein very short, poorly defined; median vein diverging at two-fifths the length of the tegmen from base of the same, bifurcate, the rami strongly sinuate; ulnar vein in general straight, weakly sinuate, multi-fractured distad, reaching the margin at the disto-sutural angle. Exposed portion of wings surpassing the tegmina by about one-fourth the greatest length of the latter, in form with the apex weakly acute, the sutural margin of the exposed portion of the closed wings straight oblique, the costal margin of same straight with a strong distal arc to the apex. Mesosternum and metasternum transverse, the former strongly so, both arcuate laterad with the lobes little reflexed.

Abdomen strongly compressed: supra-anal plate linguiform, the apex moderately acute, a distinct and broad medio-longitudinal suleus present: cerci simple, styliform, base relatively incrassate, strongly tapering mesad, distal portion very slender, needle-like, acute, the whole cereus in general form slightly inbowed: ovipositor slightly shorter than the combined length of the head and pronotum, moderately arcuate, weakly bent proximad, greatest depth contained two and one-half times in the greatest length of the ovipositor, dorsal margin almost entirely and distal fifth of ventral margin serrulate, apex rounded, ventral valves with greater portion of surface obliquely and rather closely striatulate: subgenital plate small, trigonal, apex rounded, laterad with surface impressed.

Cephalic femora about three-fourths as long as the pronotal disk, ventro-internal margin with two pronounced spines distad; cephalic tibiae slightly surpassing the femora in length, tympani of inflated proximal section apert on both faces, slender thence, with the apex slightly enlarged: median femora slender, in length nearly twice that of the cephalic femora, ventro-cephalic margin with one or two distinct distal spines; median tibiae slightly longer than the median femora, tapering distad from a relatively thickened proximal section, extremity faintly enlarged. Caudal femora one and five-eighths times as long as the tegmina, considerably inflated proximad and compressed, very slender in distal half, with genicular extremity somewhat enlarged; pattern of pagina of inflated portion evidenced by slightly irregular, simple, oblique and subimbricate lines; ventral margins with several subobsolete spines variably indicated distad: caudal tibiae slightly surpassing the femora in length.

*Allotype.*—♂; Chanchamayo, Peru. Elevation, 1000 meters. 1906. [Acad. Nat. Sci. Phila.]

Differing from the above description of the female in the following features. Pronotum with greatest caudal width of disk contained one and one-half times in the greatest length of the same, the lateral margins less diverging caudad than in the female, a weak transverse impression at caudal two-fifths of the

disk. Tegmina somewhat narrower than in the female, greatest width contained about three times in the greatest length of the same; costal margin more regularly arcuate, distal margin more oblique, disto-sutural angle broadly rounded; discoidal field with greatest width at distal third of tegmen; median vein diverging slightly more proximad than in the female. Disto-dorsal abdominal segment with the distal margin arcuato-emarginate, produced over each cercus into a short, rounded rectangulate projection, the median section of the segment with a longitudinal depression: supra-anal plate elongate, narrow, divided by a median incision into two forceps-like processes; cerci simple, tapering, gently inbowed, the base greatly thickened, tapering, the apex slender, acute, lancet-like, corneous: subgenital plate narrow, compressed, carinate mesad on ventral surface, the narrow distal margin subtruncate; styles free, very short, stout, acute.

General color of face, genae, lateral lobes of pronotum, pleura, abdomen, an oblique proximal section of the discoidal and all of the anal field of the tegmina, cephalic and median limbs and proximal two-fifths of the caudal femora, tawny-olive to snuff brown, in large part entirely minutely and closely punctulate with bone brown.

Dorsal surface of head antimony yellow, dorsal surface of pronotum pale ochraceous-orange. Tegmina in large part, and normally exposed portion of wings, mignonette green, becoming pale buckthorn brown toward the snuff brown section, which is quite solidly marked; costal margin of the tegmina with a narrow bone brown subscalariform pattern at two-thirds the length from the base, a similar edging on the costal margin of the normally exposed portion of the wings, an oblique, irregular, subreniform patch of bone brown situated near the sutural margin distad of the middle, several scattered patches or points of bone brown placed in the discoidal field distad of the large, subreniform patch.

Eyes cinnamon-brown, with a vertical sigmoid line of mummy brown across the middle; antennae cinnamon-buff with a number of well-spaced black annulations, which are relatively broad, between the proximal antennal joint and the proximal blackish-brown annulation are placed several very narrow annulations of the same color; palpi with the fourth and fifth joints lined ventrad with blackish.

Abdomen with dorsal surface clear chamois to honey yellow: male cerci prout's brown.

Cephalic and median tibiae with greater portion without punctulations, regions of the inflation of the cephalic tibiae occasionally heavily infuscate. Caudal femora, with median distal portions of the caudal tibiae, chamois, the genicular region and a distal tibial boot, with other clouds and points on the tibiae, tawny-olive to fuscous, the latter in the depressions of the tibiae.

*Measurements (in millimeters)*

| | Length of body | Length of pronotum | Greatest width of pronotal disk | Length of tegmen | Greatest width of tegmen |
|---|---|---|---|---|---|
| ♂ | | | | | |
| *P. rubiginosa*, Chapada, Brazil | 9[11] | 3.6 | 3 | 20.2 | 7 |
| *P. aurigera*, allotype | 11.1[11] | 3.7 | 2.4 | 18.7 | 6 |
| ♀ | | | | | |
| *P. aurigera*, type | 11.2[12] | 3.5 | 2.9 | 19.6 | 7 |

| | Length of cephalic femur | Length of median femur | Length of caudal femur |
|---|---|---|---|
| ♂ | | | |
| *P. rubiginosa*, Chapada, Brazil | 3.9 | 5 | 12 |
| *P. aurigera*, allotype | 3 | 4.1 | 10.6 |
| ♀ | | | |
| *P. aurigera*, type | 3.2 | 4.5 | 11.5 |

The type and allotype are the only individuals of the species which we have seen.

**Microcentrum philammon**[13] new species (Pl. XIX, figs. 7, 8 and 9.)

Related to *M. angustatum, lanceolatum, myrtifolium* and *syntechnoides*, but quite distinct from all these species. From *angustatum* it differs in the somewhat larger size, in the non-sulcate fastigium of the vertex, in the tympanal area of the right tegmen being without a subhyaline, triangular field, in the ventro-cephalic margin of the cephalic femora having spines distad, and in the styles of the subgenital plate of the male being longer than the incision of the plate, instead of short. From *lanceolatum* the new species differs in the narrower fastigium of the vertex, which is also non-sulcate, in the more compressed pronotum which also has narrower lateral lobes, in the more attenuate tegmina, in the more distinctly nodulose character of the proximal portion of the costal margin of the tegmina, in the shorter stridulating vein of the same, and in the disto-dorsal abdominal segment being non-emarginate mesad. When compared with *myrtifolium* the present insect differs in the more elongate, compressed pronotum, narrower and more elongate tegmina, more inflated caudal femora and more elongate cephalic and median limbs. From *syntechnoides* the new species differs in

[11] Abdomen shrivelled.

[12] Exclusive of ovipositor.

[13] Philammon, son of Apollo and Chione, a celebrated singer.

the narrower fastigium of the vertex, in the more compressed pronotum which also has narrower lateral lobes, in the narrower stridulating field of the male tegmina, in the shorter stridulating vein, in the more robust caudal femora and tibiae, and in the more compressed subgenital plate of the male. One of the striking features of the species is the black patellar spot dorso-proximad on the caudal tibiae.

*Type.*—♂; Puntarenas, Costa Rica. November 2, 1915. (Anastasio Alfaro; at electric light.) [Academy of Natural Sciences of Philadelphia, Type no. 5356.]

Size large: form compressed and as usual in the genus: surface smooth, weakly glabrous, tegmina with a moderate sheen.

Head with its greatest width across eyes contained one and one-half times in the greatest depth of the head; occiput gently arcuate declivent cephalad; fastigium somewhat broader than the proximal antennal joint, faintly narrowed mesad at the cephalic border of the paired ocelli, non-sulcate dorsad, meeting the fastigium of the face in a straight suture; median ocellus rather small: palpi very slender; third joint slightly longer than the fourth, the latter faintly sigmoid and narrowed at base; fifth joint elongate, longer than the third and fourth together, weakly and regularly enlarging distad: eyes but little prominent when seen from the dorsum, in basal outline circular-ovate, faintly pointed ventro-cephalad, in depth very slightly greater than that of the infra-ocular sulcus: antennae surpassing the apices of the tegmina.

Pronotum with the dorsum very faintly arcuate longitudinally, greatest (caudal) width of pronotal disk contained one and one-third times in the greatest length of the same; cephalic margin of disk emarginato-truncate, caudal margin of disk broadly and strongly arcuate with a suspicion of angulation mesad, lateral portions of disk broadly rounding into the lateral lobes, more angulate, though appreciably rounded, caudad; disk with indications of a subobsolete median carina, mesad there is indicated a reversed bipinnate, lightly impressed, figure, the caudal outline of which is narrowly acute-angulate: lateral lobes deep, narrow, the greatest width contained one and one-half times in the greatest depth, narrowing appreciably caudad; cephalic margin faintly concave, ventro-cephalic angle rounded obtuse, ventral margin very short, oblique, ventro-caudal angle broadly arcuate, caudal margin slightly oblique arcuate ventrad, slightly flattened dorsad, humeral sinus acute with the angle narrowly rounded. Tegmina surpassing the apex of the abdomen by nearly the length of the body, of the type usually found in the genus, but narrower, the greatest width (which is at the proximal third) contained three and three-fifths in the greatest length of the tegmen; costal margin regularly arcuate in the proximal half, straight in distal half, rounding to the apex, which is narrow but rounded; sutural margin largely straight: marginal field broad in proximal three-fifths of the tegmen, its greatest width equal to two-fifths of the greatest tegminal width: costal margin with the callose nodes of the proximal half distinct, rather regularly placed and decreasing in size and prominence distad:

humeral trunk strong, sigmoid; median vein diverging faintly proximad of proximal third of the tegmen, bifurcate, its rami reaching sutural margin, the sutural ramus connected with the anal vein by a short nervure; anal vein biramose, the vein not straight: stridulating field relatively narrow and elongate, its greatest width contained more than three times in the greatest length of the same, the free margin subarcuate; stridulating vein short, thick, with the accompanying vein equally long and nearly as thick; stridulating field of right tegmen coriaceous, the triangular area non-hyaline. Wings with normally exposed portion slightly longer than the pronotal disk, very acute; greatest width of expanded wing contained two and one-third times in the greatest length of the wing. Prosternum unspined: mesosternal lobes parallel; external margin straight caudad, arcuate cephalad; caudal angle acute with the immediate angle rounded, the lobes ventro-lateral in trend: metasternal lobes broader than the mesosternal lobes; external margin strongly arcuate cephalad, straight converging caudad; caudal angle rectangulate, trend of lobes as on the mesosternum.

Disto-dorsal abdominal segment transparent, the lateral section deflexed and vertical; distal margin gently arcuate produced mesad: supra-anal plate elongate trigonal, strongly reflexed: cerci moderately arcuate, relatively slender, tapering, the distal extremity slightly enlarged and subcompressed, the extremity rounded ventrad, rounded acute-angulate dorsad, the external face of apex with an adpressed, claw-like spine, not surpassing the main apex: subgenital plate compressed, boat-shaped, with a distinct median carina, produced caudad into a pair of substyliform and styliferous processes, between which the distal margin is deeply semi-elliptical emarginate; styles but little longer than the processes bearing them, on internal face concave, external face convex, apices narrowly rounded.

Cephalic femora very slightly shorter than the length of the pronotal disk, ventro-cephalic margin with one to two small spines distad: cephalic tibiae appreciably surpassing the cephalic femora in length, with both faces of tympanum apert. Median femora slightly longer than the length of the head and pronotum combined, ventro-cephalic margin with three to five small spines. Caudal femora about three-fifths as long as the tegmina, moderately compressed, fairly robust proximad, external pattern weakly indicated and irregular; caudal genicular lobes bispinose; ventro-external margin with eight to eleven spines, ventro-internal margin with seven to eight spines: caudal tibiae surpassing the femora by about one-half the length of the pronotal disk, heavy, subcompressed, narrowing in distal fourth, strongly quadrate in section, margins strongly spined.

General color of dorsum of pronotum, tegmina and exposed portion of wings courge green. General color of head and lateral lobes of pronotum chalcedony yellow to lumiere green, of the pleura, sterna and abdomen wax yellow to amber yellow. Eyes speckled pale olive brown and chestnut brown. Antennae passing from the general color of the head proximad, through ferruginous and fuscous to blackish fuscous distad, proximad the segments are individually narrowly annulate with buffy. Tegmina with the costal thickened nodes

flesh-color to ochraceous-buff; stridulating field entirely of the general tegminal color. Cephalic and median femora lime green, passing to pale courge green on the tibiae. Caudal femora lime green, weakly washed with old gold, passing to pale courge green distad; caudal tibiae pale courge green, a decided patellar spot of shining black present at the very base of the extensor surface.

Length of body, 30 mm.; length of pronotum, 7.3; greatest (caudal) width of pronotal disk, 5.9; length of tegmen, 47; greatest width of tegmen, 12.8; length of caudal femur, 28.

The type of this interesting species is unique.

**Chlorophylla inca** new species (Pl. XIX, fig. 10; pl. XX, fig. 4.)

Related to *C. rufipes* Brunner,[14] from Peru and Bolivia, but differing in the proportionately shorter and broader tegmina, which have the distal portion of the costal margin crenulate, in the shorter pronotum and in the femora being proportionately shorter.

*Type.*—♀; Chanchamayo, Peru. Elevation, 1000 meters. September, 1907. [Acad. Nat. Sci. Phila., Type no. 5355.]

Size medium: form strongly compressed, as usual in the genus: surface dull, of the pronotum scattered granulose.

Head with the greatest width across eyes contained one and one-half times in the greatest depth of head: fastigium narrow, subcompressed, slightly produced, sulcate dorsad, with apex bluntly rounded: face flattened, narrowly rounding laterad to the genae: palpi short; maxillary palpi with first joint very short, second joint slightly longer, third and fourth joints in length subequal to second, fifth joint about one and one-half times as long as the fourth joint and infundibuliform in outline; labial palpi with the distal joint moderately elongate, spoon-shaped: eyes not prominent, small, ovate circular in basal outline: antennae thick, robust, incomplete in type; margin of scrobes thickened and prominent in internal and ventral borders, with a distinct production dorsad and mesad; proximal joint large, simple, cylindrical; second and succeeding joints gradually tapering, finely, closely and briefly haired.

Pronotum sellate, the dorsum flat in transverse section, the medio-longitudinal section slightly but regularly concave, lateral angles of disk rounded rectangulate, continuous: dorsum of pronotum with its greatest caudal width subequal to its greatest length, the cephalic width of the disk but slightly more than one-half the greatest caudal width, the lateral margins of the disk parallel on cephalic third, regularly diverging on caudal two-thirds; cephalic margin subtruncate, with a series of small but distinct tubercles; caudal margin distinctly but shallowly bisarcuate, the median arcuation shallow and broadly obtuse; a faint medio-longitudinal line indicated on the disk caudad by a delicate carina, in the region of the principal transverse sulcus by a fine sulcus; principal transverse sulcus faintly arcuate, finely and deeply impressed, practically median in position, cephalic transverse sulcus distinctly

[14] Monogr, der Pseudophyll., pp. 265,266, pl. x, fig. 116, (1895).

and finely impressed, straight transverse, both sulci finely severing the lateral angles of the disk: lateral lobes with greatest depth contained one and one-half times in greatest dorsal length of same, the greatest bulk of the lobes cephalad of the middle of the lateral angles of the disk; cephalic margin of lobes concave dorsad, straight ventrad, ventro-cephalic angle rounded obtuse, ventral margin strongly and fairly regularly arcuate, ventro-caudal angle rounded obtuse, caudal margin strongly oblique concave, humeral sinus indicated merely by concavity of the whole caudal margin. Tegmina leaf-like, roughly diamond-shaped, broad, in length surpassing apices of caudal femora by a distance equal to the combined length of the head and pronotum, greatest width but slightly less than greatest length of tegmen, opaque; costal margin straight oblique in proximal three-fifths, then rounded obtuse and finally oblique crenato-truncate to the rounded obtuse apex; sutural margin with dorsal margin of closed tegmina ascending, weakly sigmoid to a broadly rounded obtuse angulation at half the length of tegmen and point of greatest width, thence obliquely weak arcuate: humeral trunk in large part straight, dividing the tegmen into two nearly equal parts, the component veins diverging at three-fifths the length of tegmen; mediastine vein distinct, in general subparalleling the costal margin; median vein diverging faintly proximad of two-fifths of the tegminal length, biramose; general venation details in figure: stridulating field relatively broad; stridulating vein heavy, arcuate, narrowing laterad, nearly transverse in position; free margin in general straight oblique distad of apex of stridulating vein. Wings falling distinctly short of the tegminal apices. Prosternum unarmed; mesosternal lobes taken together in general outline subquadrate, the lobes moderately spinose caudo-laterad, mesosternal foveolae in a single transverse orifice; metasternal lobes strongly transverse, each with a distinct conical spine, metasternal foveolae in a single transverse orifice.

Supra-anal plate moderately transverse, slightly arcuate in transverse section, the lateral margins moderately converging distad, the distal margins sinuato-subtruncate: cerci very short, but faintly surpassing the supra-anal plate, inerassate, conical in distal half: subgenital plate slightly transverse, flattened ventrad, lateral margins straight convergent, distad with two rounded obtuse-angulate projections of the margin, between which it is obtusely angulate emarginate.

Limbs of the type usual in this group, moderately inerassate. Cephalic femora with the length subequal to that of the head and pronotum combined, ventro-cephalic margin with one to three brief spines distad: cephalic tibiae distinctly longer than the femora, appreciably but not decidedly deplanate distad, tympani rimate on both faces. Median femora slightly longer than the cephalic femora, ventro-cephalic margin with two brief spines distad; median tibiae subequal to the femora in length, appreciably compressed and dilated proximad. Caudal femora about three-fifths as long as the tegmina, coarse, but little tapering, very faintly arcuate: caudal tibiae subequal to the femora in length, somewhat arcuate, heavy proximad and weakly tapering distad, subcompressed proximad, increasingly deplanate distad on dorsal surface, margins unspined.

General color of head, antennae, ventral surface, abdomen and limbs ochraceous-buff, of the tegmina mignonette green, passing to lime green in the vicinity of the distal half, the veins mesad and proximad pencilled with ochraceous-buff. Eyes tawny-olive. Pronotum ochraceous-buff, overlaid with weak wash patches of lime green and clear fluorite green.

Length of body, 18 mm. (body somewhat distorted); length of pronotal disk, 5.6; greatest (caudal) width of pronotal disk, 5.4; length of tegmen, 26.5; greatest width of tegmen, 23; length of caudal femur, 16.2.

The type of this species is unique.

**Paralobaspis gorgon** new species (Pl. XIX, figs. 11, 12 and 13.)

This striking new species is closely related to the genotype, *P. picta* Giglio-Tos,[15] described from the Valley of Santiago, eastern Ecuador, agreeing in the general features of its structure and also in the general color pattern, but differing in its appreciably larger size, in the proportionately shorter pronotum, which also has the caudal margin of the disk broadly truncate, instead of moderately produced and rotundate as in *picta*, in the proportionately shorter caudal femora, in the ovipositor being but weakly falcate, in the subgenital plate being V-emarginate with decided lateral angles, instead of triangular and fissate as in *picta*, and in numerous details of the coloration. From *P. personata* Rehn, recently described[16] from northeastern Brazil, the present species differs in numerous features, such as its very much greater size, far more elongate flight organs, straighter ovipositor, as well as general coloration.

*Type.*— ♀ ; Bartica, British Guiana. November 30, 1912. (H. S. Parish.) [Academy of Natural Sciences of Philadelphia, Type no. 5286.]

Size large (for the genus): form moderately compressed: surface glabrous to polished, the latter on limbs, head and most of pronotum.

Head with occiput subhorizontal, faintly arcuate: fastigium moderately elevated, arcuate dorsad in profile, recurved spiniform distad, the paired ocelli large and the fastigium of the vertex connected with the face by a vertical, strongly carinate ridge; median ocellus large, shield-shaped: face retreating, slightly arcuate dorso-ventrad, transversely flattened ventrad: palpi with the third joint subequal in length to the fourth, gently arcuate; fourth palpal joint straight, as a whole more slender than the third; fifth palpal joint one and one-half times as long as the fourth, straight, slender proximad, moderately enlarging distad: eyes moderately prominent when seen from the

[15] Boll. Mus. Zool. Anat. Comp. Torino, xiii, no. 311, p. 89, (1898).

[16] Proc. Acad. Nat. Sci. Phila., 1918, p. 202.

dorsum, in size medium, in basal outline rounded subtrigonal: antennae far surpassing the tegminal apices, the proximal joint moderately enlarged, with a decided disto-internal tooth-like projection.

Pronotum obscurely cribroso-punctate, with the dorsal line nearly straight: dorsum with the greatest caudal width contained one and three-fifths times in the greatest dorsal length of the same, transversely the dorsum is convex, rounding into the lateral lobes; cephalic margin of disk truncate; caudal margin of disk truncate, well rounding laterad to the humeral sinus, margins narrowly cingulate; cephalic transverse sulcus distinctly impressed arcuate, sulci caudad of this little indicated on dorsum, a median figure, between a Y and a T in shape, moderately indicated: lateral lobes with their greatest depth, which is at caudal third, contained one and one-third times in the greatest dorsal length of the same; surface of the lobes rather deeply sculptured; cephalic margin of lobes moderately oblique and sinuato-truncate, ventro-cephalic angle broadly rounded; ventral margin oblique, weakly concave, ventro-caudal angle subrectangulate; caudal margin moderately arcuate, the humeral sinus shallow, concave. Tegmina surpassing the apices of the caudal femora by about the length of the caudal femora, elongate, narrowly sublanceolate, in general subequal in width, the greatest width contained nearly seven times in the greatest tegminal length: costal margin nearly straight, distal fourth moderately arcuate to the rather broadly rounded apex; sutural margin nearly straight: marginal field broad proximad, regularly narrowing distad: mediastine vein distinct, nearly straight, reaching the costal margin near the proximal third, with numerous subparallel rami on costal side; marginal field distad of the mediastine vein with numerous oblique cross-veins; humeral trunk slightly sigmoid; median vein diverging faintly distad of the proximal two-fifths of the tegmen, biramose on the sutural side; ulnar vein sinuate, close to humeral trunk in proximal third, thence extending subparallel to the sutural margin, with five oblique true rami toward the sutural margin. Wings reaching to the tegminal apices. Prosternum bispinose; mesosternal lobes in general form rectangulate with the angle produced and spiniform-lobate; metasternal lobes distinctly shorter, in general form more rectangulate with the caudal angle subspiniform.

Disto-dorsal abdominal segment strongly transverse, deeply divided disto-mesad by a V-shaped emargination, the bordering angles being rectangulate and moderately produced, the lateral sections of the distal margin of the segment moderately oblique and shallowly arcuate-emarginate: supra-anal plate small, broad trigonal: cerci relatively short, incrassate, tapering, very slender distad, slightly incurved: ovipositor elongate, very slightly longer than the caudal femora, straight proximad, gently falcate in distal half, the greatest depth contained nearly ten times in the length; apex acute, the dorsal valves faintly longer than the ventral pair, margins entire: subgenital plate somewhat produced, weakly narrowed distad, the lateral margins (when seen from the side) sinuate oblique declivent to the distal third, thence strongly arcuate-emarginate to the acute, diverging disto-lateral angles, distal margin broadly V-shaped, the arms of this weakly arcuate, in section the plate is subtectate distad, arcuate proximad.

Cephalic femora about one and one-fourth times as long as the pronotal disk, moderately inflated, tapering more decidedly distad, ventro-cephalic margin with three distal spines, cephalic genicular lobe spiniferous, caudal one subangulate but unarmed: cephalic tibiae slightly longer than the femora, ventral margins with six spines, tympani conchate. Median femora slightly longer than the cephalic femora, ventro-cephalic margins with four regularly placed spines, both genicular lobes spiniferous, that of the caudal lobe larger than that of the cephalic lobe: median tibiae faintly longer than the femora, ventral margins armed with eight (cephalic) or six (caudal) spines. Caudal femora equal to two and one-third times the length of the pronotal disk, ventral margin nearly straight, dorsal outline strongly inflated and bullate in proximal three-fifths, very slender distad, ventro-external margin with seven spines, unarmed proximad, ventro-internal margin unarmed, genicular lobes spiniferous, the two subequal in length: caudal tibiae subequal in length to the caudal femora, strongly spined on all margins, the ventral ones less strongly and continuously so than the dorsal ones.

General color of the dorsum and tegmina auburn to bay, the pleura and abdomen brussels brown to auburn.

Face, ventral surface of fastigium, cephalic portion of genae, two proximal antennal joints, almost the entire cephalic femora and tibiae, distal portion and entire ventral surface of median femora, large portion of median tibiae, ventral surface and distal third of caudal femora and a genicular annulus on the caudal tibiae, shining blackish. Eyes auburn, blotched with blackish; median ocellus grenadine; antennae zinc orange becoming tawny distad, more or less distinctly and closely multiannulate with blackish.

Pronotum with base color of lateral lobes the same as that of dorsum, an indistinct median dot of blackish and several pairs of spots of the same in the usual position of the lateral angles, the entire pronotum with a fine cribrose pattern of ochraceous-orange. Tegmina with the base color of the marginal field largely fuscous, of the anal field weakly so, elsewhere of the general color; venation of the marginal and anal fields, and less decidedly or completely of the discoidal field, mustard yellow to cream color, the principal longitudinal veins becoming kaiser brown. Wings distinctly infumate.

Cephalic femora narrowly orange rufous proximad, the portion of the median femora which is not black being similarly colored, while the pale portion of the caudal femora is dull cadmium. Cephalic tibiae with the ventral margins largely, the distal extremity and the tarsi entirely, baryta yellow to pale orange-yellow: median tibiae similarly but less distinctly colored. Caudal tibiae ranging from amber yellow to light dull green-yellow, the dorsal surface largely fuscous, the bases of the spines and their vicinity largely fuscous; caudal tibiae baryta yellow.

Ovipositor sanford's brown, the dorsal section of the abdomen appreciably suffused with the same.

Length of body (exclusive of ovipositor), 29 mm.; length of pronotum, 6.9; greatest dorsal (caudal) width of pronotal disk, 4.1; length of tegmen, 40.5; greatest width of tegmen, 6; length of caudal femur, 17.9; length of ovipositor, 18.6.

The type is unique.

## GRYLLIDAE

**Endecous lizeri** new species (Pl. XIX, figs. 14, 15, 16 and 17.)

We have referred this species to the present genus with some hesitation, as it shows certain features not fully in accord with the generic description, as the biseriately serrulate dorsal surface of the caudal metatarsi and the presence of four distal spurs on the median tibiae, but until we know more about *E. arachnopis*, the genotype, it seems most advisable to place the new species here. From *arachnopis* the present species differs, in addition to the above features, in the larger size, more elongate male tegmina, the speculum of the same with but a single cross-vein, and other details of the venation. The female is apterous.

*Type.*—♂; Boundary between Cordoba and San Luis Provinces, Argentina. (C. Lizer.) [Academy of Natural Sciences of Philadelphia, Type no. 5328.]

Size medium: form subfusiform, more attenuate caudad: surface of body largely covered with a generally adpressed coat of short hairs.

Head with greatest width across genae contained one and two-fifths times in the greatest depth of head, seen from dorsum or front the genae are distinctly though not strongly bullate; occiput seen from side narrowly arcuate caudad, thence strongly and obliquely declivent to the interantennal region; interantennal area moderately produced, roundly obtuse-angulate, when seen from the front with its greatest width distinctly greater than that of proximal antennal joint, narrowing slightly ventrad to the small median ocellus, thence ventrad slightly widening, less distinctly haired ventrad than dorsad; face transverse, with the infra-ocular sections appreciably concave: palpi very elongate, slender; third palpal joint straight, uniform in width, subequal to the fourth joint in length; fourth joint somewhat narrowed proximad; fifth joint about one and one-half times as long as the fourth joint, slender in proximal half, enlarging distad, with the distal extremity obliquely arcuato-truncate, the whole joint weakly arcuate when seen from the side: eyes relatively small, moderately prominent, basal outline acute subovate, the point ventrad, the dorsal section of outline rectangulate, the depth subequal to that of the infra-ocular portion of the genae: antennae incomplete, proximal joint large, appreciably depressed, particularly proximad, second and remaining joints small.

Pronotum transverse, the greatest length contained one and two-thirds times in the greatest width of the entire pronotum, the dorsum straight in longitudinal section and arcuate transversely, regularly rounding into the lateral lobes, which latter are subvertical dorsad and strongly flaring laterad ventrolaterad: cephalic margin of disk truncate, caudal margin subsinuato-truncate, both margins strongly cingulate; surface of disk mesad with a small transverse depression immediately caudad of the margin, thence caudad for three-fifths

of the length with a shallow sulcation, which is slightly deepened and broadened at the exact middle, the disk slightly cephalad of the middle with a pair of transversely disposed, elongate, subpyramidical, shallowly impressed areas: lateral lobes distinctly longer than deep, the margins narrowly but strongly cingulate, excepting ventro-caudad where they are broadly and sublamellate cingulate, the surface with the apices of the paired dorsal figures reaching as sulci to the dorsal portion of the lobes, the surface ventrad moderately undulate; cephalic margin truncate, ventro-cephalic angle broadly arcuate, ventral margin rounded obtuse-angulate, ventro-caudal angle very broadly and obliquely rounded obtuse, caudal margin short, subtruncate. Tegmina coriaceous, slightly longer than the combined length of the head and pronotum, reaching to the distal margin of the third abdominal segment, when seen from the dorsum subquadrate in form, dorsal field faintly longer than broad, lateral field vertical, lateral margins of the dorsal field moderately arcuate, distal margin of the field more distinctly arcuate than the lateral margins: lateral field with its greatest proximal depth equal to about one-quarter of the length of the field, uniform in depth in proximal fifth, thence distad regularly and directly narrowing to the apex of the field, venation of the field weak: veins of the humeral trunk strong, arcuate laterad when seen from the dorsum, two in number; stridulating vein arcuate, strongly transverse, sending two complete and one incomplete sinuate oblique veins to the largely straight median vein; axillary veins two in number, well separated, strongly oblique, the sutural of the two much the heavier; diagonal vein in general arcuate; postaxillary veins two in number, sigmoid, well separated; speculum trigonal, longer than wide at the base, which is distal, with one diagonal dividing vein; cells of apical area largely subquadrate, numerous. Wings probably absent, not at all evident under the tegmina.

Abdomen with the disto-dorsal segment produced into a linguiform structure, which resembles a supra-anal plate, and is regularly narrowing caudad, distad very broadly rounded, the surface impressed proximad, elevated distad, the lateral margins narrowly cingulate proximad, with a pair of supplementary semilunate carina: cerci extremely elongate, four-fifths as long as the body, tapering: exserted internal genitalia made up of two parts, the dorsal one distad composed of a pair of elongate horny valves, which are tectate in form, with a proximal short tooth and a more elongate projection, which is distinctly expanded distad; the ventral part of the internal genitalia developed into a more elevated recurved structure, which is strongly compressed, thickened along the caudal margin and projecting dorsad through the interspace between the extremities of the dorsal valves of the internal genitalia: subgenital plate boat-shaped, strongly hollowed out, lateral margins gently arcuate laterad, distad the margin is narrowly truncate with rudiments of styles.

Limbs elongate, slender, the cephalic and median particularly sub-arachniform. Cephalic femora faintly shorter than the combined length of the pronotum and tegmina: cephalic tibiae slightly longer than the femora, tympana indicated only on the cephalic face, and there by a small oval area; distal spurs two in number, one on each side, large. Median femora subequal to the

cephalic femora in length: median tibiae slightly longer than the femora; distal spurs four in number, the ventral pair the larger. Caudal femora three-fourths as long as the body, moderately bullate for three-fifths of their length, the greatest depth contained slightly less than four times in the length of the same, ventral margins unarmed, ventral sulcus broad, deplanate; genicular spines one on each side (spines destroyed but sockets evident); genicular lobes moderately elongate, rounded distad: caudal tibiae one and one-sixth times as long as the caudal femora, relatively slender, nearly straight, dorsal margins with four pairs of mobile spurs situated on the distal five-eighths of these margins, the spurs paired but with their bases not directly opposite, the spurs faintly falcate with the apices slightly hooked, all the pairs excepting the distal have the internal distinctly shorter than the external spur, distal pair small, subequal; between the spurs and proximad of the same the dorsal margins are regularly serrato-spinulose; external distal spurs three in number, decreasing in length ventrad, the dorsal one one-third as long as the metatarsus, the median one two-thirds the length of the dorsal one, the ventral one hardly one-half the length of the median one; distal spurs of the internal face of the tibiae three in number, decreasing in length ventrad, the dorsal spur equal to one-half the metatarsal length, median spur four-fifths as long as the dorsal spur, ventral spur short, but two-fifths as long as the median one: caudal tarsi elongate, equal to one-half the length of the caudal tibiae; metatarsi occupying two-thirds of the tarsal length, compressed, weakly arcuate dorsad, dorsal margins with seven to eight external and two to four internal spines, external distal spur straight, faintly longer than the second tarsal joint, internal distal spur half again as long as the external one; second tarsal joint short, compressed; third tarsal joint elongate, compressed, faintly arcuate; claws very elongate, slender, falcate.

*Allotype.*— ♀ ; La Cumbre, Province of Cordoba, Argentina. (C. Lizer.) [Acad. Nat. Sci. Phila.]

Differing from the description of the male in the following features. Pronotum faintly less transverse than in the male, greatest length contained one and one-half times in the greatest width of the entire pronotum. Tegmina and wings absent. Ovipositor slightly shorter than the caudal femora, very slender, straight, subequal in depth except for slightly expanding proximad, distal valves not strongly differentiated from the shaft of the ovipositor valves, more compressed, when seen from the side acute lanceolate, no deeper than the shaft, external face multistriate: subgenital plate relatively shorter, compressed, subrostrate, median incision relatively deep, lateral sections of the margin gently arcuate. Cephalic femora slightly less than twice as long as the pronotal disk. Caudal femora equal in length to the body exclusive of the ovipositor: caudal metatarsi with one to no internal and four external spines.

General color liver brown to kaiser brown and warm buff, palest on the tibiae, the cephalic and median femora infuscate to a variable degree with mummy brown distad. Eyes bister. Tegmina of male russet. Female with body discolored.

*Measurements (in millimeters)*

| | Length of body | Length of pronotum | Greatest width of pronotum | Length of tegmen | Greatest width of tegmen | Length of caudal femur | Length of ovipositor |
|---|---|---|---|---|---|---|---|
| ♂, *type*..... | 17 | 3 | 4.7 | 5.7 | 4.7 | 13.5 | — |
| ♀, *allotype*.. | 15.6[17] | 4 | 5.5 | — | — | 15.8 | 13 |

The type and allotype are the only specimens of this species which we have seen. Both have suffered considerable damage in the loss of at least portions of their antennae, palpi, cerci and tarsi, while the female has the body much discolored. However, their other differential characters are very decided.

We take great pleasure in dedicating this species to our colleague Carlos Lizer, of Buenos Aires, from whom we received the material.

[17] Exclusive of ovipositor.

## Explanation of Figures

### Plate XVIII

Fig. 1.—*Eurycotis biolleyi* new species. Outline of tegmen of male (*type*). (× 5)

Fig. 2.—*Eurycotis biolleyi* new species. Supra-anal plate of male (*type*). (× 5)

Fig. 3.—*Eurycotis biolleyi* new species. Subgenital plate of male (*type*). (× 5)

Fig. 4.—*Eurycotis biolleyi* new species. Caudal tibia and tarsus of male (*type*). (× 3)

Fig. 5.—*Pogonogaster tristani* new genus and species. Lateral view of abdomen of female (*type*). (× 3)

Fig. 6.—*Pogonogaster tristani* new genus and species. Cephalic outline of head of female (*type*). (× 5)

Fig. 7.—*Diedronotus centralis* new species. Lateral view of head and pronotum of female (*type*). (Natural size.)

Fig. 8.—*Diedronotus centralis* new species. Dorsal view of head and pronotum of female (*type*). (Natural size.)

Fig. 9.—*Coscineuta matensis* new species. Dorsal view of pronotum of female (*type*). (× $2\frac{1}{2}$)

Fig. 10.—*Coscineuta matensis* new species. Lateral view of ovipositor jaws of female (*type*). (× 4)

Fig. 11.—*Coscineuta matensis* new species. Dorsal view of ovipositor jaws of female (*type*). (× 4)

Fig. 12.—*Leiotettix mendocensis* new species. Lateral view of apex of abdomen of male (*type*). (× 5)

Fig. 13.—*Leiotettix mendocensis* new species. Dorsal view of apex of abdomen of male (*type*). (× 5)

Fig. 14.—*Leiotettix mendocensis* new species. Dorsal view of fastigium of male (*type*). (× 5)

Fig. 15.—*Dichroplus forcipatus* new species. Lateral view of apex of abdomen of male (*type*). (× 5)

Fig. 16.—*Dichroplus brasiliensis* Bruner. Lateral view of apex of abdomen of male. Petropolis, Brazil. (× 5)

Fig. 17.—*Eurotettix schrottkyi* new species. Lateral view of apex of abdomen of male (*type*). (× 5)

Fig. 18.—*Eurotettix schrottkyi* new species. Dorsal view of apex of abdomen of male (*type*). (× 5)

Fig. 19.—*Eurotettix schrottkyi* new species. Outline of left tegmen of male (*type*). (× 3)

Fig. 20.—*Paraphidnia lankesteri* new species. Lateral view of male (*type*). (Natural size.)

Fig. 21.—*Paraphidnia lankesteri* new species. Dorsal view of pronotum of male (*type*). (× 3)

Fig. 22.—*Paraphidnia lankesteri* new species. Lateral view of fastigium of male (*type*.) (Greatly enlarged.)

Fig. 23.—*Paraphidnia lankesteri* new species. Cercus of male (*type*). (Greatly enlarged.)

Fig. 24.—*Anaulacomera alfaroi* new species. Lateral view of apex of abdomen of male (*type*). (Greatly enlarged.)

Fig. 25.—*Anaulacomera alfaroi* new species. Dorsal view of apex of abdomen of male (*type*). (Greatly enlarged.)

Fig. 26.—*Anaulacomera alfaroi* new species. Ventral view of apex of abdomen of male (*type*). (Greatly enlarged.)

## Plate XIX

Fig. 1.—*Chloroscirtus discocercus* new species. Lateral view of apex of abdomen of male (*type*). (Greatly enlarged.)

Fig. 2.—*Chloroscirtus discocercus* new species. Elevation of disk on cercus of male (*type*). Viewed from distal extremity. (Greatly enlarged.)

Fig. 3.—*Chloroscirtus discocercus* new species. Dorsal view of disto-dorsal abdominal segment of male (*type*). (× 4)

Fig. 4.—*Chloroscirtus discocercus* new species. Ventral view of subgenital plate of male (*type*). (Greatly enlarged.)

Fig. 5.—*Pycnopalpa aurigera* new species. Dorsal view of pronotum of female (*type*). (× 5)

Fig. 6.—*Pycnopalpa aurigera* new species. Palpus of female (*type*). (Greatly enlarged.)

Fig. 7.—*Microcentrum philammon* new species. Interantennal region of male (*type*). (Greatly enlarged.)

Fig. 8.—*Microcentrum philammon* new species. Stridulating field of tegmen of male (*type*). (× 2)

Fig. 9.—*Microcentrum philammon* new species. Subgenital plate of male (*type*). (Greatly enlarged.)

Fig. 10.—*Chlorophylla inca* new species. Dorsal view of pronotal disk and stridulating field of tegmen of male (*type*). (× 1½).

Fig. 11.—*Paralobaspis gorgon* new species. Lateral view of female (*type*). (Slightly more than natural size.)

Fig. 12.—*Paralobaspis gorgon* new species. Dorsal view of head and pronotum of female (*type*). (× 2)

Fig. 13.—*Paralobaspis gorgon* new species. Subgenital plate of female (*type*). (Greatly enlarged.)

Fig. 14.—*Endecous lizeri* new species. Pronotum and tegmen of male (*type*) from dorsum. (× 2½)

Fig. 15.—*Endecous lizeri* new species. Dorsal surface of caudal metatarsus of male (*type*). (Greatly enlarged.)

Fig. 16.—*Endecous lizeri* new species. Lateral view of apex of abdomen of male (*type*). (Greatly enlarged.)

Fig. 17.—*Endecous lizeri* new species. Lateral view of ovipositor of female (*allotype*). (× 3)

## Plate XX

Fig. 1.—*Pogonogaster tristani* new genus and species. Lateral view of pronotum and cephalic limb of female (*type*). (× 6)

Fig. 2.—*Coscineuta matensis* new species. Lateral view of head and pronotum of female (*type*). (× 3½)

Fig. 3.—*Pycnopalpa aurigera* new species. Lateral view of female (*type*). (× 3)

Fig. 4.—*Chlorophylla inca* new species. Lateral view of male (*type*). (× 2)

# THE COMPARATIVE MORPHOLOGY AND POSSIBLE ADAPTATIONS OF THE ABDOMEN IN THE ODONATA

BY ARTHUR DEWITT WHEDON

## CONTENTS

Introduction . . . 374
Problems suggested by variation in the abdomen . . . 374
Definition of the present problem . . . 375
The materials studied and their preparation . . . 376
Acknowledgments . . . 378
Comparative anatomy . . . 378
A review of general anatomy with special reference to the types studied . . . 378
Larvae . . . 380
Imagoes . . . 378
The groups compared . . . 380
External anatomy . . . 381
Modifications in size . . . 381
Modifications in shape . . . 385
Table of abdominal dimensions . . . 387
Internal anatomy . . . 389
Review of earlier work . . . 389
The morphology of the larvae . . . 390
I. Zygoptera: *Calopteryx*, *Hetaerina*, and *Lestes* . . . 390
II. Anisoptera: Aeshninae: *Anax* . . . 400
III. Anisoptera: Libellulinae: *Tramea*, *Libellula*, *Plathemis* and *Sympetrum* . . . 408
The morphology of the imagoes . . . 413
I. Zygoptera: *Calopteryx*, *Megalopreapus*, and *Lestes* . . . 413
II. Anisoptera: Aeshninae: *Anax* and *Aeshna* . . . 418
III. Anisoptera: Libellulinae: *Libellula*, *Plathemis*, *Erythemis*, *Perithemis* and *Tramea* . . . 422
Summary of comparative anatomy . . . 422
Abdominal modifications as adaptations . . . 425
Flight . . . 426
Copulation and oviposition . . . 428
Respiration . . . 429
Bibliography . . . 430
Abbreviations used in Plates . . . 433
Explanation of Plates . . . 435

## Introduction

### Problems suggested by variation in the abdomen

One of the most marked and constant characters of the Odonata is the elongated form of the abdomen. Nevertheless, there is much variation within the group in the proportions of this body region and in its length relative to that of the thorax. There are, moreover, very great differences in both size and form between the larva and the imago, no species so far as known having the abdomen as long in the former as in the latter. It is usually much wider in the nymph, universally so in the Anisoptera. These facts of abdominal structure are the more striking because they are most unexpected. The rather weak thorax of the larva must certainly be enlarged and perfected to meet the requirements of so swift, skillful and tireless a flier as the adult dragonfly: all the changes involved at transformation point to its adaptation to flight. But no such clear-cut tendencies are evinced in the abdominal changes or reasons manifest for so complete a reorganization.

The first suggestions of abdominal form as a possible adaptation to environment came from Dr. Calvert. In a series of papers published between 1910 and 1917 he not only recorded the occurrence of Odonate larvae living and maturing in the water collected between the leaf bases of epiphytic Bromeliads, as several other observers cited by him had done, but he described in detail the growth, moulting, transformation, and habits of *Mecistogaster modestus* Selys, a member of the legion Pseudostigma (subfamily Pseudostigmatinae of Tillyard) of the family Agrionidae. In his paper of 1911 he makes this remark regarding the transformation of *Mecistogaster*: "As will be seen from an examination of them (a series of photographs), the great length of the abdomen of the imago is a relatively sudden acquisition and is not foreshadowed by the size of the larva." And again (p. 410) "The excessively long abdomen of the adults of *Mecistogaster* and its allies (*Megaloprepus, Microstigma, Pseudostigma, Anomisma*) may be a special adaptation to the life of their offspring in water containing plants, since the abdomen of the larva of *M. modestus* is no longer, proportionally, than in other Agrioninae. The space between the leaf of a bromeliad and the leaf next without decreases downward, and if Mecistogaster's eggs are deposited

in the plant tissue in or near the contained water, in accordance with the general habit of the Zygoptera, it would often be necessary for the female to reach far down into the crevices possibly too narrow to admit of the entrance of her thorax and wings. The long abdomen with the ovipositor near its end would therefore be a distinct advantage, and it will be of great interest to ascertain, by future observations, if the lengths of the abdomens seen in various members of the legion Pseudostigma of de Selys are correlated with peculiarities in the length of the plants or other objects in which they oviposit."

It will be noted that this explanation would not include the male, but in his later account (1917) he adds: "The abdomens of the males of the species of *Mecistogaster* are as long or longer than those of the females. Their length of course cannot be explained in the way suggested for the females, but is possibly due to the necessary correlation in length which must exist between the two sexes to enable them to assume the characteristic mating position."

Largely gaining his information from Calvert's work on *Mecistogaster*, Tillyard states in his "Biology of Dragonflies" (1917), "In the Pseudostigmatinae, the abdomen has become excessively slender, and of enormous length. This is a secondary development, correlated with the habit of laying the eggs in the water collected between the bases of the leaves of epiphytic Bromeliads."

A careful examination of the literature of the Odonata fails to reveal further references to the subject. Studies upon oviposition, flight, respiration and other phases of the life of these insects seem entirely silent so far as any direct suggestions are concerned.

## DEFINITION OF THE PROBLEM

A consideration of these views together with a general survey of the Odonata sets before us two problems: (1) the one concerned with the origin of the elongated abdomen as a group character, (2) the other having to do solely with the further modification or adaptation of the type form to meet environmental conditions. The first is a question of phylogeny, and as the determining factors involved are, and may forever be, hidden in the obscurity of Paleozoic time, it is now far beyond the possibility

of solution. It is not yet discovered in what past period the elongated abdomen was acquired, nor is it certainly known whether it first existed as the Zygopterous or the Anisopterous type. Most writers would probably lean toward a decision in favor of the former, but it is interesting to note that Tillyard in his recent work (1917) figures additions to Brongniart's restoration of the Protodonate *Meganeura monyi* which give an intermediate character to the thorax and abdomen (basal portion only). On the basis of wing structure he distinctly places this Carboniferous form with the Anisoptera. Most fossil species are known from wings and fragments only.

An examination of the second problem is, however, quite within the present limits of research. Each of the great lines of Odonate evolution are today represented by numerous highly perfected genera and species, and to determine the structural differences or similarities between these various groups, and between the larva and the adult in each group is not only possible but of prime necessity; while in the next place an attempt can be made to correlate these structural conditions with the life activities of the insects. The outcome should be a decision as to the adaptive or nonadaptive nature of the variations in the abdomen. This paper concerns itself with these questions.

## MATERIALS STUDIED AND THEIR PREPARATION

The materials for this study were gathered from several sources and at times covering a period of more than fifteen years. From 1900 to 1911 the writer collected specimens in Iowa, and from 1911 to 1915 similar work was carried forward in the counties of southern Minnesota. Many of the larvae used came from these regions. More recently larvae and imagoes were collected in the vicinity of Philadelphia, and were especially prepared according to a variety of methods for dissection. Dr. Calvert, also, kindly furnished material from this region. The specimen of *Megaloprepus coerulatus* ♀ imago dissected was collected by him at Juan Viñas, Costa Rica, in 1909.

The earlier material from Iowa was for the most part simply dropped into alcohol or placed in papers. It was thus of little use for dissections. This was to some extent also true of the Minnesota specimens, but most of the larvae from there were

well preserved in strong alcohol and later transferred to 83 per cent alcohol.

The specimens from the Philadelphia district and those obtained from Dr. Calvert were prepared in various ways: some were killed by dropping for a moment into boiling water, opening and transferring to 83 per cent alcohol. These turned out very well on dissection; others were killed in warm Gilson's Fluid (Williamson, 1916), washed in running water, and preserved in 83 per cent alcohol. Varying periods from twenty minutes to several hours in the Gilson's Fluid were tried. The best results came with shorter or medium time of treatment. Those in longer seem ill preserved and clogged with crystals.

For the staining of parts or dissections Grenacher's Borax Carmine, after some experiment, was selected. A treatment varying from twenty minutes to two hours depending upon the size and nature of the specimen gave better results than the much longer treatment usually recommended. Cedar oil and Oil of Bergamot were used with equal success in clearing. Where permanent mounts were desired clear thick Canada Balsam was used, and in the case of thick specimens bits of object slides were placed as supports beneath the cover. It was, however, often advantageous to dissect stained material while it was immersed in the clearing fluid.

When the season permitted, the best results were obtained by keeping living specimens in papers or cages until the digestive tract was well emptied, then decapitating, splitting the body with fine sharp scissors along the desired lines, and pinning out to harden in a small wax-lined dissecting pan (an ointment box three or four inches in diameter) containing 70 per cent alcohol. After a half hour 83 per cent alcohol was applied and the specimen allowed to remain about an hour longer. It could then be taken up and placed with the proper labels in a pill vial in the same strength of alcohol. Gilson's mixture was used in the same way but seemed to have no advantages either in preserving the tissues or preparing for the stain. There is no doubt that for anatomical studies of insects the dissection of freshly killed material yields the most dependable results, but the information thus obtained is doubly certain when checked up by a simul-

taneous study of stained specimens. Whenever possible this method was used.

The equipment used in the study of the material included microscopes of three types: a dissecting stand with three triple aplanat lenses (37, 25, and 13 mm.), a camera lucida, and arm rests; a binocular microscope with 48 and 32 mm. objectives and No. 10 ocular; and a standard compound microscope. Nearly all the work was done and fine measurements taken under the binocular microscope. The camera lucida and dissecting microscope were used in sketching outlines.

ACKNOWLEDGMENTS

It is with pleasure that I acknowledge the many advantages offered me at the University of Pennsylvania. Dr. C. E. McClung has extended to me every facility the Zoological Laboratory afforded. To Dr. Philip P. Calvert I am most deeply indebted. He has not only placed material and equipment at my disposal but has given freely of his time and of his wide knowledge of the Odonata. The unlimited use of the library of the Academy of Natural Sciences of Philadelphia has been of very great value.

## Comparative Anatomy

### REVIEW OF THE GENERAL ANATOMY OF THE ODONATE ABDOMEN

Before entering upon a specific treatment of the anatomy of different forms it may be helpful to review the essential structures of the Odonate abdomen. As this has been done by other workers (Calvert, 1893; Tillyard, 1917) but the barest outline need here be set down.

#### *Imagoes*

In adults the general form is always elongate and cylindrical or subcylindrical. Of the supposed twelve original segments but ten are complete, the eleventh and twelfth being extremely reduced. In the Zygoptera the diameter is quite constant throughout the length, with slight enlargement in the basal and apical regions, while in the Anisoptera some point in the central region is widest and thickest, the form tapering towards the two ends. In general the Zygoptera are cylindrical, the Anisoptera dorso-ventrally compressed.

Each segment is composed of the usual sclerites. The tergite is very broad and covers the dorsal, lateral, and even part of the ventral aspects of the abdomen. It is heavily chitinized and further strengthened by thick ridges or lines, carinae, about the margins and even through its interior. In Anisoptera the following are present: (1) the anterior transverse carina bordering the anterior suture, (2) the posterior transverse carina bordering the posterior suture, (3) the ventral carinae following the pleural margins of the tergite, (4) the mid-dorsal carina along the median line, (5) the lateral carinae forming the lateral angles of the body, and (6) supplementary transverse carinae usually found in the more anterior dorsal portions of the terga of the basal segments of the larger forms. The posterior, transverse, lateral, mid-dorsal, and supplementary transverse carinae may be more or less denticulate. Their importance will be clear when the muscle attachments are described. The Zygoptera usually lack the lateral and supplementary transverse carinae, but are in other respects as stated above.

The pleura are narrow, non-chitinized bands between the terga and the sterna. They bear the spiracles only, except the ninth and tenth, these lying toward the anterior end and just back of the second lateral processes of the sternum. Considerable difficulty is experienced in most species in drawing the overlapping tergum back from the sternum far enough to give a clear view of the pleura.

The sternite is an elongated, narrow, slightly ventrally convex plate which narrows backward and ends in a pointed, highly chitinized process or sternellum, this overlapping the anterior broadly rounded end of the succeeding sternite which in turn extends a little forward of the anterior transverse carina of its segment. An anterior and a posterior pair of sternal processes (apodemes), rib-like chitinous rods, lie at and back of the intersegmental suture. These and the point of union between sternum and sternellum are regions of muscle attachment. In Zygoptera the sternum is almost completely concealed by the approximated edges of the tergum. In all forms, however, the sterna of the basal three segments are visible: in the female as plates, in the males with modifications due to the copulative organs.

The anus is located in the tip of the abdomen in both sexes. The genital pore of the male, with its pair of longitudinally placed valvules perforates the ninth sternite. As mentioned, the organs of intromission in the male are developed in the sterna of the second and third segments. In the female the genital pore lies between the eighth and ninth segments ventrally and is covered by the accompanying gonapophyses which originate from these sterna. The gonapophyses vary from three well-developed pairs—the anterior and median processes for piercing and sawing, and the valves—in the Zygoptera, to a reduced bifid or entire vulvar lamina or scale in some Anisoptera.

Springing from the dorso-lateral regions of the tenth segment in both sexes is a pair of anal (superior) appendages. An "inferior" median appendage lies just above the anus in the males only of the Anisoptera. A pair of true inferior appendages (homologs of the cerci, according to Heymons) lie right and left of the anus in the male Zygoptera. In both groups these anal appendages in the male are highly adapted for grasping the head or the prothorax of the female while pairing.

### *Larvae*

In the larvae the form is very much shorter and thicker, especially in the Anisoptera. It may be quite cylindrical (Zygoptera), subcylindrical (Aeshninae), or greatly flattened (Gomphinae and some Libellulinae). It possesses the same segments as that of the imago but their sclerites are far simpler in structure and function. The tergum is a great arch but it has, in Anisoptera at least, no ventral portion. The sternum is a flat, rectangular plate, and the pleura are chitinized and approach a horizontal position (Plate XXIII, figure 9). Spiracles may be present but are nonfunctional. Lateral spines occur frequently towards the hind end of the body, and dorsal spines are possessed by many running water forms. The anal appendages need not be described here.

## GROUPS COMPARED

The results recorded in this paper were obtained from the dissection and study of the following material. Many species not listed here were used for comparison, especially of external anatomy.

ZYGOPTERA:

Agrioninae: *Calopteryx maculata* Beauvois and *Hetaerina americana* Fabricius.

Lestinae: *Lestes unguiculatus* Hagen, *L. rectangularis* Say and others.

Coenagrioninae: *Enallagma sp.* and *Ischnura posita* Hagen.

ANISOPTERA:

Gomphinae: *Hagenius brevistylus* Selys, *Gomphus amnicola* Walsh, *G. fraternus* Say and *G. exilis* Selys.

Aeshninae: *Anax junius* Drury and *Aeshna umbrosa* Walker.

Libellulinae: *Libellula pulchella* Drury, *Plathemis lydia* Drury, *Erythemis simplicicollis* Say, *Perithemis domitia* Drury, *Sympetrum rubicundulum* Say, *S. semicinctum* Say and *Tramea carolina* Linnaeus.

## EXTERNAL ANATOMY

Both comparative morphology and paleontology agree in support of the view that the Agrioninae are the most primitive of living Odonata. Garman (1917) has recently summed up the points of importance in such phylogenetic study: they total thirty-five. Of this number the Agrioninae are generalized in twenty-six, the Coenagrioninae in twenty-four, the Aeshninae in ten, the Gomphinae in nine, and the Libellulinae in but five. It is unnecessary to review the evidence here. Reversing our view, the Agrioninae are specialized in but nine points as against thirty points in the Libellulinae. Personal judgment may vary on certain points but there can scarcely be a doubt regarding a decision where corroborative evidence is so great, and we are perfectly safe in assuming the characters of the Agrionid abdomen to be most primitive. It is here, in both larva and adult, tubular, slender, of nearly equal diameter throughout and several times as long as the thorax. In the higher groups it is modified in (1) size and (2) in shape.

### *Modifications in Size*

A table comparing the dimensions of the abdomen in a selected list of the commoner species representative of the subfamilies of North American dragonflies is given below. A glance at the column of abdominal lengths for the adults will immediately

show that the *absolute lengths* are decidedly greater in the Agrioninae than in the Libellulinae. The number of species dealt with is of course too few to afford a basis for establishing the average or the mean for each subfamily, but there can be no doubt of a very considerable percentage of difference between these groups, especially the extremes. By reference to the ratios between the length of the synthorax and that of the abdomen it is just as clear that the latter has decreased in *relative length* in the higher groups. For example: the abdomen of *Calopteryx maculata* ♂ measures 35 mm. while that of *Tramea carolina* ♂ is but 28 mm. The synthorax of these species is respectively 5.5 mm. and 9.5 mm., giving a ratio of thorax to abdomen of 1:6 in the former and 1:3 in the latter. If a third example is selected from the lower Anisoptera, *Hagenius brevistylus* or *Gomphus cornutus*, an increase over *Calopteryx* in absolute length may be seen, but the length relative to the synthorax gives the ratio 1:4, which stands intermediate between 1:6 and 1:3. Very roughly speaking thoracic-abdominal ratios for each of these selected subfamily groups approximate the following: Agrioninae 1:6; Lestinae 1:5.5; Coenagrioninae 1:5; Gomphinae and Aeshninae 1:4.5; and Libellulinae 1:3. A valid generalization could only be reached after a much more extended survey. The Pseudostigmatinae can here be represented by but two species, *Mecistogaster modestus* and *Megaloprepus coerulatus* with ratios (♀) of 1:10 and 1:8.9. It may be of value to note two species of about the same body length, thorax plus abdomen: *Hetaerina americana* and *Pantala hymenaea* measure about 40 mm., but the abdomen of the former is 34 mm. and that of the latter 29 mm.; the thorax is 6 mm. and 10.5 mm. respectively. Thus a reduction of about one seventh of the abdominal length is accompanied by an increase of almost two times in the thorax. The thorax of *Pantala* is also much larger in other dimensions.

The sexes vary in the size of the abdomen. Another examination of the table will show that the male is generally 1 or 2 mm. longer than the female, as well as being more slender. Infrequently the difference is as great as 3 mm. In the Lestinae the females of the various species on our list are often so nearly alike both in coloration and size as to make them inseparable in the absence of the males. But when we include the males also, the

species instantly fall into two groups—those in which the variation in length between males and females is normal (*Lestes unguiculatus, forcipatus*, etc.) and those in which the male exceeds the female by at least 4 mm. and often as high as eight millimeters (*Lestes rectangularis, curinus* and perhaps *vigilax*). Sufficient material is not at hand to determine how much of this variation is due to large and small specimens and how much to actual variation in the abdominal length, the thorax remaining constant. *Lestes rectangularis* seems to have the widest range.

It is especially essential to note at this point that in some species the female is consistently longer than the male: *Ischnura verticalis*, one of the commonest, most widely distributed, and successful of the Zygoptera is very constant in this respect. The male abdomen varies from 20 to 22 mm., that of the female from 23 to 25 mm. This is true of *Ischnura posita* also. In *Lestes* this is, naturally, uncommon, but even here the male of *L. uncatus* is slightly shorter than his mate; *L. forcipatus* is often so. *Anomalagrion hastatum* and *Chromagrion conditum* are like *Ischnura*. The *Enallagmas* tend toward equality between the sexes, there being but few cases known to the writer of variation in favor of the female. The *Argias* are normal with but one or two exceptions among American forms.

The North American species of Anisoptera show, from lower to higher groups, a procession from females markedly longer than the males to equality or even to longer males. The subfamilies may be characterized as follows:

Gomphinae: In form and, in many genera, in size the Gomphinae possess the most highly modified abdomen of the Odonata. The females of *Hagenius* and *Gomphus* quite generally exceed the males in length. In some closely allied genera the sexes seem equal. The ratio of thorax to abdomen is also greater, indicating that the females are not simply the larger specimens.

Aeshninae: There are few if any exceptions to the normal condition of male longer than female in this group. The reverse may at times be true in *Epiaeshna heros*. Walker (1912) gives measurements of all the North American species of *Aeshna* derived from a large collection of specimens. In the case of *Aeshna mutata* only does there seem a distinct difference in favor of the

female; the length of the thorax is here the same in both sexes with an abdominal variation of at least 3 mm. *Aeshna multicolor*, a very close relative of *mutata*, shows tendencies in the same direction. The same is true of *A. interrupta interrupta*.

Cordulinae: *Didymops* appears to have the females the longer. Williamson's (1909) revision of the North American species of *Macromia*, though based upon limited collections, is as yet the most extensive work upon the genus. He gives full measurements. In but two of his nine species, *M. australensis* and *M. pacifica*, are the females the shorter. Usually the difference is not great but in *M. wabashensis*, of which but one female was taken, it is greater: male 54.4 mm., female 58 mm. Much the same size relation exists between the sexes of *Epicordulia princeps*. If we may judge from Muttkowski's "Studies in Tetragoneuria" (1911) and from a half-dozen specimens in the writer's possession, *Tetragoneuria* shows nothing but the normally shorter female. The genus *Somatochlora* seems, though it has not been well worked up, on the other hand to reverse the condition, having females perhaps a millimeter the longer: *S. filosa*, however, has lengths of 41 mm. for the male and 48 mm. for the female.

Libellulinae: The most noticeable characters of this group are the reduced length and increased width of the abdomen, and its uniformity in shape. The normal relation between sexes is but seldom changed and then only slightly as in *Sympetrum vicinum* and *corruptum*, *Pantala flavescens* and *hymenaea*, and *Tramea onusta*.

Size is a matter of much less variation in the larvae than in the adults. There are but two general types: the tapering cylinder of the Zygoptera and the oval ventrally flattened forms of the Anisoptera. The measurements of a few representatives of the groups are given in the table (page 388). These were taken from material in hand. In addition use has been made of Garman's (1917) measurements of Zygoptera, and of figures on *Mecistogaster* furnished by Dr. Calvert. So far as comparisons have been made the ratios of thorax to abdomen have fallen close to 1:3.5 in the Zygoptera, 1:3 in the Gomphinae and Aeshninae, and 1:2.5 in the Libellulinae. Very few species have, however,

been available for study. In Zygoptera the relation of greatest width to length of abdomen is 1: 5 or 1: 6, and there seems very little variation in size between species that differ much as imagoes. In the Gomphinae the abdomen is widest at about the fifth or sixth segment and is quite or even very wide. The ratio for *G. cornutus* is about 1: 3.4 for thorax and abdomen, and 1: 3 or 1: 4 for width and length of abdomen. The nymph of *Hagenius* (plate XXVI, figure 30) is a very remarkable one, having a flattened nearly orbicular abdomen four-fifths as wide as long. The larvae of the Libellulinae are thick bodied.

When the relation of larval to adult abdomen is observed, the ratio of 1: 5 for *Mecistogaster* is unapproached by anything else; the next in line being 1: 3.7 to 1: 4.3 in *Argia* (*apicalis* 1: 3.8, *moesta putrida* 1: 3.7, and *tibialis* 1: 4.3). In the Lestinae, *Lestes rectangularis* is 1: 2.5, and in the Coenagrioninae the *Enallagmas* are from 1: 2.3 to 1: 3. The Anisoptera show differences running from 1: 4 in certain Gomphi and 1: 1.7 in *Aeshna* to 1: 2.6 in *Sympetrum*. Such figures are but the crudest approximations, as exact ratios must be obtained from a series of larvae or exuviae and the adults they produce. Except in the cases of *Mecistogaster modestus* and *Gomphus cornutus* these are not at hand. The general conclusion that less difference exists in abdominal dimensions between nymph and adult in the higher groups than in the lower is certainly safe.

### *Modifications in Shape*

A description of minute details of comparative shape is not necessary for the purposes of this paper. A few general conditions should be mentioned.

The slender cylindrical form of *Calopteryx* with its slight dilation in the first and second segments and at the tip is scarcely changed throughout the Zygoptera. Between the sexes there are only such differences as are necessary to accommodate the sex organs, and to allow for the attachment of the muscles activating the anal appendages in the male or the ovipositor in the female. Carinae are not strongly developed, and accessory carinae are never present.

In the Gomphinae and many of the Cordulinae the slender, cylindrical form is very pronounced, especially through the greater

central portion, but with a tendency to lateral compression. The swollen region of the first three segments is about equal in the two sexes, though the male organs project more beneath. A thickening of the segments from seven to ten in most of the Gomphinae and in *Macromia* produces a clubbed effect. This appearance is enhanced in the former by the out-turning of the usually ventral, lateral margins of the terga, forming narrow winglike expansions. Females show less of this and are stouter. In *Macromia* the constriction beyond the second segment occurs rather suddenly and is soon followed by a gradual thickening until the greatest diameter is reached in the eighth, giving a very graceful and mobile form. In these and most of the following groups the swollen base of the abdomen so approaches the massive thorax in size and contour as to cause a gradual transition from one to the other of these regions of the body.

In the Aeshninae various modifications exist from the tapering, tubular form of the great *Epiaeshna heros* to the conditions in *Aeshna* where the venter becomes flatter, the longitudinal carinae distinct and the great enlargement of the anterior segments is immediately succeeded by the narrowest part of the abdomen in the third segment, somewhat similar to the constriction in the Hymenoptera. *Anax* differs from *Aeshna* in being of heavier build, less narrowed in the third segment, and in having a tendency toward dorso-ventral flattening and the further development of longitudinal lateral carinae.

The typical form in the Libellulinae is much depressed dorso-ventrally, with well marked mid-dorsal carina, broad, flat venter, and gradually tapering width. Frequently, especially in the females, the ventral portions of the terga are turned outward as in the Gomphinae but to less extent. A cross-section of the abdomen is often triangular. These characters hold for even such minute forms as *Nannothemis* and *Perithemis*.

The anal appendages mentioned in an earlier section are very diverse in different groups and even so to the species. They form the favorite characters for the determination of many species. As their size, however, is small compared with the rest of the abdomen, and they seem used exclusively in pairing, it is unnecessary to discuss them here.

Table Comparing Abdominal Dimensions in The Odonata

| | Length of synthorax | | Length of abdomen | | Widest segment of abdomen[1] | | Ratio of length of synthorax to length of abdomen | |
|---|---|---|---|---|---|---|---|---|
| ZYGOPTERA. | ♂ | ♀ | ♂ | ♀ | ♂ | ♀ | ♂ | ♀ |
| AGRIONINAE: | | | | | | | | |
| *Agrion maculata* | 5.5 | 5.5 | 35 | 35 | $2.7^9$ | $2.^{\cdot}$ | 1:6.4 | 1:6.2 |
| *Agrion angustipennis* | 7.2 | 7 | 45 | 42 | 1.6 | 1.8 | 1:6.2 | 1:6 |
| *Hetaerina americana* | 6 | 6 | 34 | 32 | $1.6^9$ | 1.4 | 1:5.7 | 1:5.3 |
| LESTINAE: | | | | | | | | |
| *Lestes rectangularis* | 5.5 | | 40 | | $1.5^9$ | | 1:7.3 | |
| *Lestes curinus* | | | 38 | 34 | | | | |
| *Lestes vigilax* | | | 37 | 35 | | | | |
| *Lestes unguiculatus* | 5.3 | 5 | 29 | 27 | $1.5^9$ | $1.6^9$ | 1:5.5 | 1:5.4 |
| *Lestes forcipatus* | 5 | 5.6 | 28 | 27 | $1.4^9$ | $1.6^9$ | 1:5.6 | 1:4.8 |
| *Lestes uncatus* | 5.3 | 5 | 29 | 27 | $1.5^9$ | $1.6^9$ | 1:6.5 | 1:5.4 |
| PSEUDOSTIGMATINAE: | | | | | | | | |
| *Mecistogaster modestus* | | 7 | | 70 | | $1.5^9$ | | 1:10 |
| *Megaloprepus coerulatus* | 11 | 9.5 | 105 | 84.5 | $3.^9$ | 5.5 | 1:9.5 | 1:8.9 |
| COENAGRIONINAE: | | | | | | | | |
| *Ischnura verticalis* | 4 | 4 | 20 | 22 | $1.^9$ | $1.2^7$ | 1:5 | 1:5.5 |
| *Enallagma carunculatum* | 5 | 4.5 | 25 | 25 | $1.5^9$ | $1.5^9$ | 1:5 | 1:5.5 |
| *Coenagrion resolutum* | 4 | 4 | 23 | 23 | 1 | 1 | 1:5.7 | 1:5.7 |
| ANISOPTERA. | | | | | | | | |
| GOMPHINAE: | | | | | | | | |
| *Hagenius brevistylus* | 14 | 14.1 | 58 | 60 | $5.^9$ | $6.^{\cdot}$ | 1:4.1 | 1:4.3 |
| *Gomphus amnicola* | 8 | | 36 | | $3.^2$ / $4.1^8$ | | 1:4.5 | |
| *Gomphus fraternus* | 10.5 | 10 | 37.5 | 37.2 | $3.^2$ / $4.8^8$ | $4.^2$ / $4.^8$ | 1:3.6 | 1:3.7 |
| *Gomphus cornutus* | 9.5 | | 40 | 40 | | | 1:4.2 | |
| AESHNINAE: | | | | | | | | |
| *Anax junius* | 12 | 12 | 48 | 49 | $7.^2$ / $3.^3$ | $8.^5$ | 1:4 | 1:4.1 |
| *Aeshna constricta* | 11 | 10 | 48 | 47 | $6.^2$ / $3.2^{\cdot}$ | $6.^2$ / $3.5^9$ | 1:4.4 | 1:4.7 |
| *Epiaeshna heros* | | 12 | | 56 | | $6.^2$ / $4.7^5$ | | 1:4.7 |
| CORDULINAE: | | | | | | | | |
| *Macromia illinoiensis* | 12 | | 51 | | $3.8^2$ | | 1:4.3 | |
| *Epicordulia princeps* | 9.5 | | 39 | | $4.5^2$ | | 1:4.1 | |
| *Tetragoneuria cynosura* | 7 | 7.8 | 26.5 | 27.6 | $3.6^2$ | $3.5^2$ | 1:3.8 | 1:3.5 |

[1]An exponent indicates the number of the segment measured.

| | Length of synthorax | | Length of abdomen | | Widest segment of abdomen[1] | | Ratio of length of synthorax to length of abdomen | |
|---|---|---|---|---|---|---|---|---|
| LIBELLULINAE: | | | | | | | | |
| *Libellula pulchella* | 11 | 12 | 30.5 | 31 | 5.4[2] | 6.[5] | 1:2.8 | 1:2.6 |
| *Libellula quadrimaculata* | 10 | 10 | 26 | 26 | 5.[3] | 4.4[3] | 1:2.6 | 1:2.6 |
| *Plathemis lydia* | 11.5 | 10.5 | 26.5 | 25 | 5.[3] | 5.[3+9] | 1:2.3 | 1:2.4 |
| *Perithemis domitia* | 5.5 | 5.5 | 14 | 13.5 | 2.[2]<br>2.6[8] | 2.[2]<br>3.[8] | 1:2.5 | 1:2.5 |
| *Nannothemis bella* | 4 | 4.5 | 13 | 13.5 | 1.5[8] | 1.5[2]<br>2.[9] | 1:3.3 | 1:3 |
| *Sympetrum semicinctum* | 6.3 | 6.3 | 20 | 21 | 2.2[2]<br>2.3[8] | 2.7[2] | 1:3.2 | 1:3.3 |
| *Leucorhinia intacta* | 6.6 | 7 | 21 | 20 | 3.[8] | 2.4[8] | 1:3.2 | 1:2.9 |
| *Celithemis eponina* | 8.8 | 8 | 25 | 25 | 3.[2] | 2.8[2] | 1:2.9 | 1:3.1 |
| *Pantala hymenaea* | 10.5 | 10 | 29 | 31 | 4.6[2] | 5.[2] | 1:2.8 | 1:3.1 |
| *Tramea carolina* | 9.5 | 8.2 | 28 | 27 | 4.[2] | | 1:2.9 | 1:3.3 |

*Larvae*

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| ZYGOPTERA. | | | | | | | | |
| AGRIONINAE: | | | | | | | | |
| *Agrion maculata* | | 4 | | 14 | | 3 | | 1:3.5 |
| LESTINAE: | | | | | | | | |
| *Lestes unguiculatus* | | 4 | | 14 | | 2.5[2] | | 1:3.5 |
| PSEUDOSTIGMATINAE: | | | | | | | | |
| *Mecistogaster modestus* | 3 | | 15 | | 2.5[1] | | 1:5 | |
| ANISOPTERA. | | | | | | | | |
| GOMPHINAE: | | | | | | | | |
| *Hagenius brevistylus* | 8 | | 24 | | 20.3[7] | | 1:3 | |
| | 6.4 | | 16 | | 9.[3] | | 1:2.5 | |
| *Gomphus cornutus* | 8 | 8 | 26 | 29 | 7.2[5] | 9.2[5] | 1:3.3 | 1:3.6 |
| AESHNINAE: | | | | | | | | |
| *Anax junius* | 9 | | 29 | | 9.5[7] | | 1:3 | |
| *Aeshna constricta* | 9.5 | | 29 | | 9.[7] | | 1:3.1 | |
| LIBELLULINAE: | | | | | | | | |
| *Libellula pulchella* | 7 | | 16 | | 8.2[6] | | 1:2.3 | |
| *Plathemis lydia* | 6 | | 14 | | 7.2[6] | | 1:2.2 | |
| *Sympetrum semicinctum* | 3 | | 7.5 | | 4.5[7] | | 1:2.5 | |
| *Tramea carolina* | 5.5 | | 14 | | 9.[6] | | 1:2.5 | |

[1] An exponent indicates the number of the segment measured.

## INTERNAL ANATOMY

The comparative anatomy of the Odonate abdomen has received very scant attention. This is especially true of the adult and even in extensive monographs, as that of Amans (1885) on flight, the abdomen is scarcely mentioned. Investigation into anatomy has been prompted by its necessity in the solution of physiological problems and was carried only far enough to meet such need. Great interest in flight has led to a thorough study of thoracic structure; the tracheae have been extensively mapped by workers on respiration for half a century past, and very carefully studied by Tillyard (1917) in his recent work on rectal respiration; the abdominal muscles have been discovered and connected with respiratory functions by investigators from Dufour (1852) to Wallengren (1914). Plateau, again interested in respiration, worked upon the abdominal muscles of the imago, but with this exception European writers have virtually limited themselves to the larva of *Aeshna grandis* as material. In this country Marshall (1914) has summed up our knowledge of the general morphology and histology of the alimentary canal and reproductive organs of the Libellulinae in his paper on *Libellula quadrimaculata*, while for the most specific accounts of the systems of the Zygoptera we are indebted to Calvert's careful studies of the larvae of *Cora*, *Mecistogaster*, and *Thaumatoneura* (1911, 1911, and 1915).

The present paper is concerned with the digestive, nervous, reproductive and muscular systems of both the larvae and the adults of species selected from each of the three larger groups of Odonata. The object of the account is four-fold: (1) to summarize our knowledge of past work, (2) to add new facts that have appeared as the dissection of worked types was repeated or that of new types carried out, (3) to compare types of the suborders, and (4) to compare the structures of the adults with those of the larvae. This should result in a clearer view than has as yet been presented in the comparative morphology of the Odonata, and throw some additional light upon the functions and adaptations of the abdomen.

The work upon the reproductive system included here will be found less complete and definite than that on the other systems because of the lack of full development and of functional condition in all but mature imagoes.

The respiratory system has only been touched upon incidentally. It has been considered from several aspects by many other investigators, and what still remains to be done is of such nature as to make it a problem by itself and to preclude its consideration as a part of a discussion of general comparative anatomy. Some doubt may also be expressed as to its details having a bearing upon our problems of abdominal adaptation. This is very well suggested by Amans (1885) in the introduction to his excellent study of flight. He says: "L'importance de ce systeme (respiratory) a été fort contestie, et après mûre reflection j'ai rejeté son étude de mon travail. L'appareil respiratoire offre dans la serie animale une trés grande varieté, et pas une seule disposition jouant un rôle mécanique constant." But while there are suggestions pointing toward room for doubt in the case of the Odonata, it is impossible to include its investigation in this paper.

Nothing has been attempted upon the histology of the systems described, or upon the anatomy of the circulatory system.

## *The Morphology of Odonate Larvae*

### I. Zygoptera

Dufour (1852) more than half a century ago figured and described the alimentary canal and tracheae of the larvae of two European members of the Zygoptera: *Calopteryx virgo* and *Agrion puella*. His details are few and his terms now archaic. Little else was done, if we neglect the tracheae, until the appearance of Calvert's papers between 1910 and 1917. While based upon limited material these papers offer a sound basis and a modern terminology for further work. Tillyard's general work (1917) follows the same lines in part.

Three species have been dissected by the writer: *Calopteryx maculata*, *Hetaerina americana*, and *Lestes unguiculata*. Partial studies were also carried out on *Ischnura posita*. Due to a large amount of full grown and well preserved material *Lestes* and *Hetaerina* have served best for most of the work. Certain specimens in the penultimate moult gave excellent results. Most of the dissections were made by incision along the mid-dorsal line, after which the walls were pinned out flat; some were split ventrally and treated in the same way, while others were cut along each side and the dorsum removed. As the muscles especially are

very transparent it was usually necessary to stain the specimens before continuing the dissections of parts.

The description below applies to *Lestes unguiculatus* unless otherwise noted. The dimensions of this species will be found in the table on page 387.

## Alimentary Canal
## (Plate XXI)

As the Alimentary Canal is a long straight tube directly attached only at the pharynx and anus its whole course beyond the head must be described.

The Oesophagus emerges from the occipital foramen as a very small, thin-walled tube which immediately expands to a moderated diameter (two to three times the diameter of the foramen) and then gradually increases throughout the thorax, in the posterior third of which it becomes pouch-like by ventral enlargement. (Calvert [1915], apparently following Dufour or Sadones seems to limit the oesophagus to the very short cephalic and prothoracic region, the pouched portion then being considered a crop ["jabot" of Dufour and Sadones].) Throughout the thorax it is very thin and, when not distended with air or food, marked with longitudinal creases or folds. Near the union of thorax and abdomen it turns abruptly dorsad in most specimens and after slight constriction enters the crop. This point of union (elbow) is encircled by several apparently muscular cords or very narrow bands, which, lying in a single layer, form a broader band. (Plate XXI, figure 1.)

A Visceral Sheath (plate XXI, figure 2, vs.) of thin but tough connective tissue completely surrounds the digestive tract from the anterior end of the abdomen to the seventh segment. It does not fit closely the enclosed tube, in preserved material at least, but is of uniform diameter until it reaches the intestine and rectum. Here it is not completely closed over the mid-dorsal line and is more uneven in diameter, and gradually thinning out and disappearing. Its color is brown due to the great number of fine tracheae that arise internally from the lateral (ventral, of Tillyard) trunks and form a network upon its surface. It must be opened to expose the abdominal portions of the canal.

The Crop (plate XXI, figure 1, cr.) extends from the posterior part of the metathorax to the suture between the third and fourth

segments—a little more than three segments long. Its cephalic end is rounded and often slightly enlarged. The remaining portion runs straight caudad, increasing in diameter for two thirds of its length and then tapering to its union with the gizzard. The whole structure has a transversely wrinkled wall.

The position of the Gizzard (plate XXI, figure 1) is peculiarly different in the many specimens dissected: in the females it lies normally in the second segment in front of the ventriculus, but in the males it seems to be projected caudad into the ventriculus for just two-thirds the latter's length. It was not positively ascertained that this is a sex difference but some fifteen or twenty specimens were dissected with this result, though one male was found with the gizzard in the second segment. The armature of the gizzard has been well worked out by Miss Higgins (1901) and will not be discussed here. She also records considerable variation in the position of the gizzard in different species and in members of the same species, including some sex differences. These latter, however, neither seem so constant as is true in *Lestes unguiculatus* nor is there any record of such excessive projection into the ventriculus (Op. cit. pp. 131–132). *Calopteryx* has the gizzard between the third and fourth segments.

The Ventriculus or Midgut (plate XXI, figure 1, mg.) extends through the fourth, fifth and the greater part of the sixth segments. Its surface is very smooth in both outline and texture, its only irregularities being due to the contents of the tract. It is widest (1 mm.) between the fifth and sixth segments, the point occupied by the gizzard in the males; cephalad it is also slightly swollen about the invagination of the gizzard. Encircling its extreme hind end is a whorl of Malpighian tubules. These branch and extend caudad through the seventh, eighth, and part of the ninth segments; they are very closely applied to the sides of the intestine and rectum. Their exact number was not investigated.

The remaining portion, the Hind Gut, of the Zygopterous alimentary canal is very difficult to interpret without extensive histological work. Tillyard (1917, page 101) makes the statement that it is undivided, but the results obtained by Carroll (1918) on *Mecistogaster*, and Miss Cullen (1918) on *Argia moesta putrida* clearly prove that this is not the case. No histological examination was made of the *Lestes* material but several divisions may be made out with the binocular in an ordinary dissection: a long,

straight region of quite even diameter throughout most of segment seven (the ileum, the three divisions of which cannot be made out); a decided bulbous enlargement throughout most of the eighth segment (probably the pouched region of Carroll); a short, constricted section entering segment nine; and a very much thickened cylindrical region running through the ninth segment and most of the tenth. This enlargement has three broad folds along its whole length and between them thin, darkly pigmented areas; one of these folds is mid-dorsal, the other two latero-ventral (anterior part of the rectum, of Carroll). The hind part of segment ten is occupied by a small vestibule leading to the anus, the walls of which are well supplied with tracheae. Both *Calopteryx maculata* and *Hetaerina americana* have the same structure (plate XXI, figures 1 and 2; plate XXV, figure 22). Calvert (1911, 1915) has shown this same nature for the "anterior part of the rectum" in *Thaumatoneura* and *Mecistogaster*.

### Reproductive Organs
### (Plate XXI, figures 2 and 3)

The reproductive organs are relatively simple in the Odonata, consisting of gonads, ducts, receptacles and accessory sacs. Each of these is unbranched and the discharge of the products is by a single genital pore. In 1896 Fenard reviewed and criticised the work of Reaumur and of Rathke, and added the results of his own dissection of *Libellula depressa* adult. This accords with the descriptions of Tillyard (1917).

In the larvae these organs are of course only in partially developed states, and the writer knows of no descriptive work on their stages of growth and maturation. Calvert (1915, plate XV, ts and vd) indicates the male organs of a full grown larva of *Thaumatoneura*, and also of *Cora* (1911, plate III, ts) but no descriptions are given. Quite full grown larvae have been used in the present study, and it is a very noticeable fact that the Zygopterous larvae have gonads as well developed as those of even advanced teneral imagoes of the Anisoptera. A comparison of the *Lestes* larva (plate XXI, figures 2 and 3) and the teneral imago of *Tramea* (plate XXVIII, figure 38) indicates this. As would be expected also the sex glands are relatively better developed and more conspicuous in the larvae than are the accessory parts.

Male: (plate XXI, figure 3). The testes extend throughout the seventh and eighth segments. They are irregularly cylindrical and attached along the dorsal edge of the visceral sheath where it lies open caudad of the sixth segment. A pair of tracheae occupy the dorsal and ventral lines of the testis and their lateral branches form a network over the whole organ. The diameter of the gland is about .5 mm. and its length nearly 3 mm. The vasa deferentia are short and curve directly caudad and ventrad about the rectum to a sperm sac the size of the last abdominal ganglion which lies in the median line just posterior to the center of the ninth segment. This sac is markedly cordate in outline when viewed from above and is flanked by the Ventral Retractor Muscles of the Anus and the dilators of the rectum. The two posterior branches of the nerve cord as they diverge pass tangent to the antero-lateral portions of the lobes, and dorsal to them. There is no enlargement of the vasa deferentia as they run beneath the muscles into the sperm sac. The dorsal trunks (tracheae) lie just outside of and slightly below the testes. The genital pore open to the exterior beneath the sac.

Female: (plate XXI, figure 2). The Ovaries of the full grown *Lestes* larva are cord-like structures lying mid-dorsally upon the visceral sheath from the posterior part of the metathorax to the posterior part of the seventh segment. The dorsal blood vessel separates them a little. They are bound to the sheath, to one another, and to the heart by fine tracheal branches. They are thickest in the fifth and sixth segments and taper each way, ending in attenuated points in front. In the posterior part of the seventh segment they diverge and, gradually decreasing in diameter and flattening out, disappear beneath the visceral sheath as oviducts. If the intestine is severed at the anus and turned forward, the oviducts may be traced beneath the outer posterior corners of the sternal muscles of segment seven and into an oval bursa copulatrix or seminal receptacle immediately posterior to the last ganglion. The receptacle is somewhat larger than this ganglion, and lies in the fork between the posterior nerve branches. Arising from the dorsal surface of the oval sac is a much larger trilobed diverticulum. Not being filled at this stage in the life history, it is compressed laterally by surrounding organs. A duct leads to the genital pore which opens posterior to the bursa

at the apex of the eighth segment. No accessory sacs were made out. The cord-like appearance of the ovaries indicates well formed egg tubes within them.

At this stage the ovipositor (external) is quite complete. Its three pairs of gonapophyses reach beyond the apex of the tenth sternite.

## The Nerve Cord
## (Plate XXI, figure 1)

The work on this system is limited to the study of the ventral nerve cord or chain. In general plan the Odonata are like other insects in this respect. In the thorax there are three very large and closely approximated ganglia. There are eight abdominal ganglia, but after the earlier larval stages the first ganglion is drawn forward as first shown by Calvert (1899) and united with that of the metathorax, where it can be seen partially imbedded, in the later stages. This causes the ganglion of the second segment to move forward into the first, leaving the second segment vacant in fully grown larvae and in adults.

Tillyard (1917, page 132) states that he first discovered this fact in the dissection of the adult *Petalura*, and adds that he thinks the shifting must "take place either before or during metamorphosis, and is correlated with (a) the decrease in the size of the first abdominal segment to a narrow ring, and (b) the great elongation of the abdomen of the imago as a whole." He further remarks upon the stretching of the nerve cord in the adult and its supposed effect in the location of the ganglia.

The dissection of a series of larvae, from those just hatched or which have moulted but once or twice to those full grown, shows that this shifting of ganglia comes about very early in all groups, certainly before any great changes in the proportions of the thorax and abdomen have occurred. In fact, the change has already taken place before the larva is large enough to be dissected. Such being the case it would seem to have little to do with the elongation of the abdomen.

A glance at the figure of *Lestes* (plate XXI, figure 1) shows that the seven abdominal ganglia are all located in the extreme anterior ends of their respective segments, with minor variations in the third and eighth segments. The ganglion of the third has been

drawn almost within segment two, while in the eighth it lies slightly farther back in the segment than usual. In size they are about equal, except that the last is always much the largest. Their form varies from nearly round or oval to an inverted pear-shape. Each has several pairs of lateral branches. There seems to be no sex variation in the nerve chain. The connectives are so closely approximated as to form a single cord throughout most of its length.

## The Muscular System
## (Plate XXI)

No previous exhaustive work has been done upon the muscles of Zygopterous larvae. There are occasional references to them in the literature of general or special subjects, only. Calvert has given partial figures of them in his studies of *Cora* and *Thaumatoneura*, but has named only the more conspicuous ones.

The straight, tubular body of the larva is heavily lined on all sides with relatively thick muscles. The great number of these run longitudinally and are limited to the segments in which they arise. Certain muscles in the end segments of the abdomen are intersegmental. Abdominal muscles are devoid of tendons, and origins and insertions occur by means of direct union to the chitinized body wall or to the in-turned folds along the sutures and joints (the "Randwulste" of Wallengren). (plate XXIII, figure 12.)

In the naming of muscles as distinct from one another the writer has decided wholly upon the criterion of origin and insertion: a muscle body with these regions common is considered a single muscle, but if there is a common origin but two or more regions of insertion, two or more muscles are taken to be present. This is a problem that very frequently arises, as insect muscles lack the definite sheath of vertebrate muscles and very easily split up into their component fibers. Fixation is sure to bring this about more or less.

The longitudinal muscles of any sclerite are often superimposed upon one another in a way that makes them very difficult to discover. Many of them are also quite small, in fact, so small as to be indistinguishable even in stained material until laid bare. For these reasons most workers, considering muscles but incidentally, have overlooked them. As Wallengren's (1914) work on *Aeschna*

*grandis* is the only exhaustive treatment of the subject, the writer of the present paper has worked out the Anisoptera first, using Wallengren's nomenclature, and what follows on the Zygoptera is the result of comparison with this higher suborder.

Segmental Muscles of the Sternum:—

The Primary Longitudinal Sternal Muscles (plate XXI, figures 1 and 4, pls.) lie on either side of the nerve chain in segments two to eight, one pair to each. Each muscle is about two-fifths the width of the sternum, the margin of which is a little lateral to that of the muscle. They arise on the extreme cephalic end of each segment and run parallel to the nerve cord to a similar position on the next segment. The mode of attachment is clearly shown in plate XXIII, figure 12. They are very thick, rectangular bands, one and one-half to two times as long as wide, which serve to bend the abdomen ventrally when the members of the pairs work together, and to bend the body to one side when one member contracts as the other relaxes. In the Aeshninae they are replaced by two pairs, one of which, the Primary (Plate XXIII, figure 8, pls. and lpsp) lies nearer the sternum and runs as in the Zygoptera, the other, the Secondary, dorsal to it runs obliquely outward to the edge of the sternum posteriorly. In certain segments there is also a third pair.

The Secondary Longitudinal Sternal Muscles are absent in the Zygoptera.

The Tertiary Longitudinal Sternal Muscles (plate XXI, figure 1, tls) of which there is one pair in each of the first eight segments, are very small and of varying proportions in the different segments; in the first they are very minute and nearly square; in the eighth they are half the length of the segment. There is a gradual change from front to back. The insertion is always on the posterior suture very near the median line, and the origin upon the surface of the sternum. The greater part of the muscle, especially in the anterior segments is covered by the Primary Longitudinal Sternal Muscles.

The Quaternary Longitudinal Sternal Muscles (plate XXI, figure 1, qls) are still more minute and lie, one pair to a segment, near the pleuro-sternal suture. Their origin and insertion is like that of the last named muscles. They are always completely covered by the Primary Longitudinal Sternal Muscles.

Segmental Muscles of the Tergum:—

The Primary Longitudinal Tergal Muscles (plate XXI, figures 1 and 4, plt) are similar to the opposing sternals. They are widest anteriorly and diverge a little toward their insertion, leaving an inverted triangular space in which the chamber of the heart lies, and into which the Tertiary Longitudinal Tergal Muscles project from above and forward. They are replaced in the Aeshninae by two pairs as in the Sternals. They occupy the dorso-lateral aspects of the tergum, and are present in all but the tenth segment. They attach to the suture-folds as do the Sternals.

The Secondary Longitudinal Tergal Muscles are absent.

The Tertiary Longitudinal Tergal Muscles (plate XXI, figure 1, tlt) lie in pairs beneath and between the last named, along the mid-dorsal line flanking the heart. They are very short, not over one-third the length of the segment, and about two-thirds as wide as long. Their origin is upon the face of the pleurite and their insertion is upon the suture-fold dorsal and slightly internal to that of the last named muscles.

The Quaternary Longitudinal Tergal Muscles (plate XXI, figure 1, qlt) are larger than the Tertiary being approximately half the length of the segment and half as wide as long. They originate on the surface of the tergite above the ventral side of the Primary Longitudinal Tergals and run straight caudad to insert upon the usual region of the suture-fold. They are in position opposed to the sternal muscles of the same name.

In the first, ninth, and tenth segments many of the regular sternal and tergal muscles are replaced by others for the anchoring of the abdomen to the thorax and the movement of the anal appendages. In all probability these were originally derived from the Primary Sternals and Tergals (unless we take the ground that the latter were derived from the intersegmental muscles common in other groups of insects) but they are now mostly intersegmental and separate names are desirable.

The Ventral Sternal Thoracico-Abdominal Muscles (plate XXI, figure 1, vsta). There are two pairs of these ventral muscles, an outer and slightly dorsal one, and an inner one partly covered by the outer. The inner has its origin just lateral to the median line of the central part of metasternite; the outer a little posterior

to the metathoracic ganglion. They increase in diameter as they pass caudad and insert along the posterior suture of the first sternite, the insertion of the two equaling in width that of the Primary Longitudinal Sternal Muscle of the second segment.

The Lateral Sternal Thoracico-Abdominal Muscles (plate XXI, figure 1, lsta). According to Wallengren these compound muscles are inserted on a thin mesothoracic membrane which is stretched over the thoracic ganglia. This membrane is very distinct in *Lestes* and the insertion seems to be directly over the last ganglion. Passing backward and outward the two parts of this muscle increase rapidly in size, and attached to the suture between the thorax and the first abdominal segment near the margin of the sternum; from this point back to the first segment a broad, bandlike "posterior portion" or extension of these muscles runs to insert upon the posterior suture beneath the Median Sternal Thoracico-Abdominal Muscle. In fact, these "posterior portions" ("hintere Partien desselben muskels") are quite completely covered by the muscles named.

Tergal Thoracico-Abdominal Muscles are not developed.

Muscles Controlling the Anal Appendages, Rectum, and other appendages:—

The Ventral Adductor Muscles of the Lateral Appendages (plate XXI, figure 1, vad). These are intersegmental, with their broad origins at the anterior suture of the ninth segment and their insertions on small, chitinous processes from the inner ventral bases of the lateral appendages. Their shape is that of a narrow V. Just interior to this pair lies another and much more slender pair.

The Ventral Retractor Muscles of the Anus (plate XXI, figure 1, vra) which originate similarly to the above named but unite posteriorly and insert upon the ventral wall of the rectum near the anus.

A pair of Ventral Dilator Muscles of the Rectum (plate XXI, figure 1, vdrt) may also be discovered as small muscles with their origins contiguous with and dorsal to the Retractors. They run directly back to the rectal wall near the anus.

The Abductor Muscles of the Lateral Appendages (plate XXI, figure 1, ala) lie in the latero-ventral regions of the tenth segment. They are V-shaped.

The Adductor Muscles of the Dorsal Appendage lie latero-dorsally, and consist of a broad, V-shaped pair, also in the tenth segment. They insert upon the lateral bases of both the dorsal and lateral appendages.

The small Dorsal Dilators of the Rectum were not clearly made out. There seemed to be suggestions of a pair in the tenth segment.

Dorso-Ventral and Oblique Segmental Muscles:—

The Dorso-Ventral Segmental Muscles (plate XXI, figures 1 and 4, dv). In Zygopterous larvae the first nine segments possess a pair each of very thin, delicate vertical muscles laterally placed. The origin of each is upon a dorso-lateral longitudinal line of the tergite, and the insertion is along a similar line near the edge of the sternite. The muscle is a little shorter towards the ends of the segment and in some cases there is a tendency to break the band up into separate divisions; this is, however, not constant. It is nearly as wide as the segment is long, and, of course, very short. It seems better developed in *Hetaerina* and *Calopteryx* than in *Lestes*.

The Dorso-Ventral Oblique Segmental Muscles (plate XXI, figures 1 and 4, dvo). These are present in the first to the ninth segments. Each is a narrow band running from one end of the segment to the other, slanting ventral and caudad. Its origin is upon the anterior tergal suture-fold a little lateral of the mid-dorsum, where it is broadest, and its insertion is upon the suture-fold at the end of the sterno-pleural suture, or partly beneath the end of the Primary Longitudinal Sternal Muscles. It lies internal to the Vertical Dorso-Ventral Muscle but its upper half is dorsal to the Primary Longitudinal Tergal Muscle, the pressure of which flattens it greatly.

No traces of Transverse Muscles or Diaphragms were discovered.

## II. Anisoptera. Aeshninae

On account of their large size and the ease with which they can be obtained the larvae of *Aeschna grandis* have served as material for most European work on Odonate physiology and anatomy during the past half century or more. Dufour's paper of 1852

is a good example of the earlier investigations of this Aeshnid, while such work as Matula's in 1911 and Wallengren's in 1914 offer the best basis for further work. None of these papers treat of the complete anatomy or physiology of this species: Dufour considers the nervous, respiratory, circulatory, and digestive systems; Amans (1881) the digestive and respiratory systems; Viallanes (1884) gives a brief laboratory synopsis of the external features, the mouth parts, alimentary canal, main tracheal trunks, and the nerve chain; Matula and Wallengren are interested in the nervous system and the respiratory movements and so touch upon the muscles and the skeleton.

The following results were obtained from the dissection of *Anax junius*. Specimens of all sizes were available in numbers. A few were collected in the act of moulting and furnished very transparent material. Part of the dissection was carried out in 70 per cent alcohol without staining, much more after staining, and some study was made of parts mounted in balsam. Constant dissection is, however, the method to be advised, especially upon the sternal and tergal muscles.

## The Alimentary Canal

(Plate XXII, figures 5 and 6, al.)

Compared with the digestive tract of the Zygoptera that of the Anisoptera is more complicated. The addition of respiration to the functions of the rectum is partly responsible for this. The three general divisions are much the same—fore gut, mid gut, and hind gut—but some of the regions are more specialized in their activities.

The Oesophagus runs back through the head, turns dorsad for a very short distance after passing the occipital foramen, turns again toward the axis of the thorax and rapidly enlarges as it traverses the prothorax, mesothorax and about half of the metathorax. Here it turns ventrad and constricts slightly, but immediately expands again to form the large oval crop which occupies the first two segments of the abdomen. The walls of both these divisions are marked by longitudinal wrinkles. The accompanying figures were drawn from a quite fully grown moulting larva, the digestive tract of which was distended with air.

The Gizzard lies normally in the anterior part of the third segment, where the ventriculus is moderately invaginated by it.

There is no marked constriction between crop and gizzard. The armature of the gizzard consists of four heavy triangular processes or tubercles, each with small teeth.

The Ventriculus or Midgut occupies most of the third, all of the fourth, and the anterior two thirds of the fifth segment. It is usually three-lobed, above the portion into which the gizzard projects being of the greatest diameter, the middle one about twice as wide as long, and the posterior part oval and tapering down to meet the Small Intestine. It is supported behind by a muscular diaphragm.

The Small Intestine thus begins near the union of the fifth and sixth segments, where it lies just dorsal to the nerve cord, runs a short distance caudad, turns directly dorsad, expands dorsally to form the Pre-rectal Ampulla ("Ampoule Prerectale" of Sadones), narrows abruptly again and enters the rectum above the median axis of the abdomen. The anterior half of the small intestine is comparatively small in diameter; the posterior part or ampulla is a large, thin sac forced well to the dorsal region by the pressure of the adjacent parts. It is trilobed when viewed from above.

The Rectum fills segments six to ten and consists of two portions: the Branchial Basket and the Vestibule. The former is so large as not only to crowd out the other organs from the sixth to the ninth segments but also to make this the thickest part of the abdomen. It tapers gradually from the beginning of the eighth to the middle of the tenth segment. The structure and functions of this organ are fully discussed by Tillyard (1917). The Vestibule is a short, cylindrical rectal chamber leading to the anus. Its walls are supplied with tracheae, and to them the dorsal and ventral dilator muscles of the rectum attach.

Numerous Malpighian Tubules open into the alimentary canal as usual at the hind end of the ventriculus.

### The Reproductive System
### (Plate II, figure 6)

Male:—The Testes are well developed, irregularly cylindrical in shape, and lie lateral to and below the Dorsal Tracheal Trunks. Their position will be made clear by reference to plate XXII,

figure 6. In full grown larvae they extend from the middle of the fifth to near the hind end of the eighth segment. In dorsal view they adhere to the side of the tracheal trunks until close upon the branchial basket, when they abruptly turn aside and ventrad a short distance, then turn dorsad again and run parallel to the trunks and for a half segment beyond their tips. The Vasa Deferentia are small tubes of uniform diameter which continue into the ninth segment, run beneath the anterior end of the Adductor Muscles of the Lateral Appendages, approach the median line and turn a little forward to unite with the sides of the Sperm Sac. The latter is of perfect cordate shape, and smaller than the eighth ganglion. It lies in the triangular space between the sternal muscles in the anterior part of the ninth segment.

Female:—The Ovaries seem less developed than the testes in larvae of the same size. They are flattened, cord-like bodies similar to those of *Lestes* lying between and ventral to the dorsal trunks, which they follow very closely from the first segment to the fifth. In the region of the posterior lobe of the ventriculus they narrow down to the size of the oviducts and run on backward and downward about the alimentary canal. They pass beneath the sternal muscles of segment seven about the middle, converge and pass over the suture into segment eight, run beneath the sides of the eighth ganglion, unite with each other for a short distance and connect with the Sperm Receptacle or Bursa Copulatrix. This is very small and undeveloped. No Accessory Sacs were discovered.

## The Nervous System

(Plate XXIII, figures 8, 9, and 10)

The nerve chain of *Anax* and *Aeshna* does not differ materially from that of *Lestes*. The first ganglion lies against that of the metathorax in the same way; the other seven, however, are placed at the middle of each segment. The last one is as usual about twice the size of the others. The connectives are closely approximated forming a cord with nothing but a median line to show its paired nature; the connectives between the last two ganglia are separated by a space less than the width of one of the connectives. There is also a slight separation of those between the ganglia of the mesothorax and the metathorax.

## The Muscular System
(Plate XXIII, figures 8 to 12)

As stated above, the papers of Matula (1911) and of Wallengren (1914) are the only ones that are concerned with the muscles of the abdomen of the Anisopterous larva. The former of these is very superficial from the side of anatomy, as only the larger sets of muscles are figured or described. Wallengren has not limited himself to the respiratory muscles, but has undertaken to discover and systematically describe all the abdominal muscles of the larva of *Aeschna grandis*. His figures are excellent. His nomenclature, derived from earlier workers on insect muscles, is largely followed in the present paper; the Latin form is not used, however.

The Aeshnid larva is the most complex of those of the various subfamilies: especially is this true of the muscles. Only such details as were not described in the previous section on *Lestes* will be given here.

Segmental Muscles of the Sternum:—

The Primary Longitudinal Sternal Muscles (plate XXIII, figure 8, pls.) are found in segments two to eight inclusive. They differ from those of the Zygoptera in diverging caudad and increasing in size toward the posterior segments. In segments four to seven inclusive a longitudinal division has occurred giving rise to the following pair:

The Lateral Primary Longitudinal Sterno-pleural Muscles (plate XXIII, figure 8, lpsp). These have their origin on the posterior side of the anterior suture-fold lateral to the origin of the primary Longitudinal Sternal Muscles in each segment. They run caudad and laterally over the posterior suture narrowing as they go, and insert upon the inner anterior portion of the pleurite (epimerite). Wallengren considers these two muscles but two portions of the same muscle—the Primary Longitudinal Sternal—a median and a lateral. However, as they do not have the same insertion and as their origins are not at the same point but side by side, it would seem clear that they are two different muscles at present, whatever may have been their origin.

The Secondary Longitudinal Sternal Muscles (plate XXIII, figure 8, sls). These thinner, band-like muscles are nearly parallel to the median line and are covered by the Primary set. In segments two, three, and four a small anterior-lateral corner of one of the muscles is not covered over. It is not clear how many portions or divisions exist; in most segments there seem to be two, but in other segments or in other specimens four divisions appear to be present. They are always of uniform width throughout. Wallengren shows two pairs of these to each segment, slightly divergent posteriorly, in *Aeschna grandis*.

The Tertiary Longitudinal Sternal Muscles (plate XXIII, figure 8, tls). These are short, wide, and thin muscles lying partly beneath the secondaries, and concealed by the overlying muscles except at the inner mesal posterior corner. They have their origin upon the face of the sternite just posterior to the level of the nerve ganglion and slightly interior to the margin of the Primary Longitudinal Sternals. From these points they converge caudad and insert upon the suture-fold. They are here separated by a distance equal to the width of one of the muscles. They are especially modified in the female.

The Internal Tertiary Longitudinal Sternal Muscles (plate XXIII, figure 8, itls). These are not represented in *Aeshna* according to Wallengren or Matula. They are very slender, cylindrical muscles lying parallel and median to the last named; they are stoutest in the anterior segments. As they originate a very little farther forward than the Tertiary Longitudinal Muscles they are the longer of the two. They insert very close together beneath the nerve cord. In the seventh segment of the female they appear to associate with the oviducts and become intersegmental; this is not perfectly clear, however.

The Quaternary Longitudinal Sternal Muscles (plate XXIII, figure 8, qls) are similar to the Tertiary Muscles but are smaller and weaker, and located near the lateral edges of the sternum. They are concealed by the Secondary Sternals.

Segmental Muscles of the Tergum:—

The Primary Longitudinal Tergal Muscles (plate XXIII, figure 11, plt) correspond to the sternals of the same name and lie in similar positions, but none of them are divided as in the

case of the sternals of segments four, five, six, and seven. They are much narrower at the anterior end. They are the most ventral of the tergal muscles.

The Secondary Longitudinal Tergal Muscles (plate XXIII, figure 11, slt) are very similar to the Primary Tergals, but lie dorsal to them and slant in the opposite direction (converging a trifle caudad). They seem frequently to be made up of four divisions or bands, and are thinner than the primaries.

The Tertiary Longitudinal Tergal Muscles (plate XXIII, figure 11, tlt) are the analogs of the Tertiary Sternals. They are dorsal to the Secondaries and converge caudad to their insertions upon the suture-fold. Their origins are, as are those of the remainder of the Tergal Muscles, upon the face of the tergite. They are wide and short in the anterior and become longer and more slender in the posterior segments.

The Quarternary Longitudinal Tergal Muscles (plate XXIII, figure 11, qlt) correspond to the Internal Tertiary Sternals. They are dorsal to the Tertiary Tergals and in the first, second, and eighth segments lie vertically over the medial portions of these, but in segment seven they are entirely internal to the latter. They are shorter than the tertiaries.

The Quinary Longitudinal Tergal Muscles (plate XXIII, figure 11, qnlt) are very similar to the Quaternary but are scarcely more than half as thick. They are dorso-lateral in position, and have their origins just dorsal to those of the Dorso-ventral Segmental Muscles and above the lateral margin of the Primary Secondary Tergals.

The Sextic Longitudinal Tergal Muscles (plate XXIII, figure 11, sxlt) lie above the Secondary Tergals somewhat nearer the mid-dorsum than the Quinary Muscles. They are comparable to the Quarternary Muscles in size, origin and insertion, but are largest in the first segment and decrease to the ninth. In the latter they each insert upon a sharp, horn-shaped, chitinous point which projects forward from the anterior end of the tenth segment. These muscles are very clear in *Anax* but are not shown by Wallengren in *Aeshna*.

Thoracico-Abdominal Muscles:—

The same sets of muscles occur here that were noted in *Lestes*, their positions and attachments being very similar. They are

the Ventral and the Lateral Sternal Thoracico-Abdominal Muscles (plate XXIII, figure 8, vsta, lsta, lstah.). They seem also to coincide with those of *Aeshna* as described by Wallengren. Muscles Controlling the Anal Appendages and the Rectum are also so nearly like those of *Lestes* and *Aeshna* as to need no description.

Dorso-ventral and Oblique Muscles:—

The Dorso-ventral Segmental Muscles (plate XXIII, figures 8, 9, 10, and 11) are very strongly developed as compared with the Zygoptera, and are different as to their insertion. They are found in all segments from the first to the ninth, and are strongest in the sixth and seventh. In segments one, two, three, and four they seem to be single, thick and somewhat flattened: from the fifth to the ninth they consist of three muscles—a large fore one, a smaller hind one, and a middle and slightly internal one, which is very much the weakest. They run vertically parallel with one another except the central one which is a trifle oblique. The insertion of the group occupies the greater part of the pleurite (epimerite) in all but segments one and nine where it is upon the sternum. The origin covers a broad lateral line on the tergum, the central division being a little higher up than the other two. The condition is the same in *Aeshna*.

The Dorso-ventral Oblique Intersegmental Muscles of the Aeshnidae (plate XXIII, figures 8, 9, 10, and 11, dvo) take the place of the similar, but segmental, muscles of the Zygoptera. They are present in all segments but the tenth, and run from the anterior-lateral corner of the pleurite and the suture-fold of one segment to a point on the anterior suture-fold of the next segment receding, just beneath the lateral corner of the Secondary Longitudinal Tergal Muscle. They are broadest and flattened at the upper ends and nearly cylindrical at the lower ends, and are powerful muscles. They pass interior to the Dorso-ventral Segmental Muscles.

Transverse Muscles:—

These seem very similar in *Anax* and *Aeshna*.

The Subintestinal Transverse Muscle (plate XXIII, figure 8, str; plate XXII, figure 6, str) is a heavy, spindle-shaped, though slightly flattened muscle, the ends of which attach to the pleurites

of the sixth segment on either side at their extreme anterior-lateral points (on the suture). It lies between the fore end of the branchial basket and the vertically directed short intestine, below the pre-rectal ampulla and above a mass of Malpighian Tubules. When relaxed it bows forward to near the middle of the fifth segment. Matula figures it in the fifth segment but Wallengren places it in the sixth, as it is, also, in *Anax*. It is about 8 mm. long and 1.3 mm. wide.

The Muscular Diaphragm (or Supraintestinal Muscle of Matula) (plate XXII, figure 6, di) has been shown by Wallengren to be a true diaphragm possessing a dorsal and a ventral portion. It is attached to the lateral regions of the tergum of the extreme anterior end of the fifth segment. Its ventral portion is similar to but weaker than the Subintestinal Muscle; its dorsal portion is a broad and very thin muscular sheath which would stand vertically were it not for the large lobe of the ventriculus which passes beneath it and throws it into an oblique plane. It can be distinctly seen in a dissection from the dorsal side, binding down the mid gut. Its attachment does not run more than two thirds of the distance to the mid-dorsum on either side. Thus the dorsal tracheal trunks are not affected by it.

### III. Anisoptera. Libellulinae

Very little work has been done on the Libellulidae. Sadones in 1896 gave a fairly complete account of the digestive tract, and something on the respiratory system of *Libellula depressa*. His results on the alimentary canal have been used as a basis for most of the subsequent investigation of this phase of the organization of the Anisoptera. In 1905 Scott published an account of the distribution of the tracheae in *Plathemis lydia* and included a little work on the digestive system.

The present work was done mainly upon *Tramea carolina*, with occasional comparisons with *Libellula*, *Plathemis*, and *Sympetrum*. The *Tramea* larvae are the most transparent known to the writer, and many structures may be examined through the body walls without dissection. The tracheae can be traced everywhere with remarkable sharpness.

The following account makes no attempt at complete description; only such points as are peculiar to the species studied will

be dwelt upon. *Tramea* is to be understood in the absence of other mention.

## The Alimentary Canal
## (Plate XXIV, figure 14)

As Libellulid larvae are short and stout, this is also a marked characteristic of the alimentary canal: its chambers tend towards being pear-shaped and are spacious.

The Oesophagus always has a sharp, double or S-shaped bend in the hind part of the head and the prothorax after which it dilates gradually into the crop. This in turn constricts near the center of the synthorax and is followed by a characteristically oval gizzard possessing an armature of two pairs of plates, or ridges, carrying very large, sharp, recurved teeth, two large or five or six smaller ones. The gizzard of *Sympetrum* is not set off from the crop by a constriction as in *Tramea*, *Libellula* and *Plathemis*.

The position of the gizzard has been found to vary greatly in different specimens. Whether this was due to normal position or to displacement in dissection could not be fully determined. The usual position in *Tramea* seemed to be in the first and second segments of the abdomen; however, younger larvae often had it in the central portion of the synthorax. Specimens cut into right and left halves with the scissors seemed also to vary; those cut towards the head having the gizzard crowded into the thorax and those cut toward the abdomen with it as far caudad as the third or even the fourth segment. The presence of the transverse muscles near the middle of the abdomen seemed to allow of no shifting of the hind gut. In specimens with the dorsum removed there was wide variation. These statements apply to all the species studied.

It is very probable that shifting occurs normally when the chambers of the oesophagus, crop, and ventriculus are successively filled and emptied. The muscular diaphragm (see page 408) is also an exceedingly thin and elastic band which can easily be pressed backward by the pressure of incoming food, but which can just as readily push the gizzard forward by its contraction and consequent flattening. In *Tramea* this diaphragm, it will be noted, is attached to the anterior end of the

fourth segment, two segments in front of the strong subintestinal muscle. It is therefore free to move the ventriculus and gizzard through this distance at least. When the muscle is relaxed and the ventriculus is as far caudad as possible the posterior end of the gizzard is on the line between the second and third segments; and as the ventriculus is large, the gizzard is pushed into the thorax when the diaphragm contracts.

The gizzard projects but a short way into the much larger ventriculus. This is always pear-shaped and with the large end forward. It reaches well into the fifth segment where it enters the Short Intestine after receiving a whorl of short Malpighian tubules.

The Small Intestine passes into the sixth segment, doubles back upon itself and passes dorsally to join the branchial basket. Its dorsal part expands to form the pre-rectal ampulla as usual.

There is nothing peculiar about the branchial basket and the vestibule except the large size of the former.

### The Reproductive System

This system has not been as carefully worked out in the larvae of the Libellulinae as in the case of *Anax*. The positions and stages of development of the gonads in full grown larvae seem to be about the same. The sperm receptacle of the female is usually oval, large enough to lift and crowd forward the nerve ganglion, and in *Tramea* it was seen to have two small recurved accessary sacs toward its posterior end. The oviducts follow the usual path beneath the sternal muscles. There is nothing of special note regarding the male reproductive system.

### The Nervous System
### (Plate XXIV, figure 13)

Due to the stoutness of the body in all of these forms the ganglia are closer together than in the Aeshnids, and the connectives lie well apart. The relative sizes of the ganglia have not changed appreciably. The eighth in the female is always saddled upon the enlarging sperm receptacle.

### The Muscular System
### (Plate XXIV, figures 13, 14, 15, and 16)

The organization of the muscles is in certain respects intermediate between that of the Aeshnidae and the Zygoptera. The

longitudinal muscles of both sternum and tergum resemble *Lestes*; the dorso-ventral muscles are more like those of *Anax* and *Aeshna*. The appendages are controlled by a similar mechanism in all groups.

Segmental Muscles of the Sternum: (Plate XXIV, figures 13 and 15)—

The Primary Longitudinal ternal Muscles replace both the Primary and Secondary sets of *Anax* and *Aeshna*. In this respect they are like those of *Lestes*, but in position they diverge slightly caudad as in *Anax*. Each muscle is wider than long and forms an undivided sheet. The larvae of *Libellula*, *Plathemis*, and *Sympetrum* are similar in respect to these muscles.

The Secondary Longitudinal Sternal Muscles are absent.

The Tertiary Longitudinal Sternal Muscles (plate XXIV, figure 13, tls.) lie in the usual position with their ends just showing along the sides of the median space occupied by the nerve cord.

There are no Internal Tertiaries.

Segmental Muscles of the Tergum: (Plate XXIV, figures 15 and 16)—

The Primary Longitudinal Tergal Muscles (plate XXIV, figures 15 and 16, plt) are even wider than the corresponding sternals, and seem to have the same structure, *i.e.*, each is a broad thick band.

There are no Secondary Longitudinal Tergals.

The Tertiary Longitudinal Tergal Muscles (plate XXIV, figure 16, tlt.) are well developed, increasing in size from the anterior to the posterior segments but never being more than half the length of their respective segments.

The Quaternary Longitudinal Tergal Muscles are absent.

The Quinary Longitudinal Tergal Muscles (plate XXIV, figure 16, qlt.) are short and broad. They are on the lateral regions of the tergum and are thus not covered by the Primaries.

Thoracico-abdominal Muscles: (Plate XXIV, figure 13)—

Both sets of these muscles are clearly shown in the figures. They are like the rest of the longitudinal muscles in being single plates.

Muscles Controlling the Anal Appendages and the Rectum:—

These are present and differ in no essential respect from those already described.

Dorso-ventral, and Oblique Intersegmental Muscles: (Plate XXIV, figures 13 and 15—

The Dorso-ventral Segmental Muscles are of two very distinct types:

(1) The Tergo-pleural Muscles (plate XXIV, figures 13, 15, and 16) which are vertical, heavy, cylindrical muscles located in the anterior half of each segment. They do not attach to the sternum. Through the central segments they are made up of a number (3 to 5) fascicles, but near the thorax they dwindle to one fascicle each. The origin of each muscle is broad and is spread over the tergite dorsal to the lateral margin of the Primary Longitudinal Tergal Muscle, *i.e.*, it is between the tergite and the muscle named. As it runs directly ventrad it becomes cylindrical. Its insertion covers most of the anterior end of the pleurite.

(2) The Tergo-sternal Muscles (plate XXIV, figure 15, dvts). Each muscle has its origin upon a broad, roughly crescent-shaped area of the tergum in the posterior part of each segment ventral to the level of origin of the Tergo-pleural Muscle. Its insertion is partly, or wholly, upon the lateral margin of the sternum near its middle part. This muscle is thick, and as it passes from tergum to sternum it twists about its axis as it bends around the Tergo-pleural Muscle. If viewed in transverse section of the body the two muscles are seen to cross like the bars of the letter X.

The Dorso-ventral Oblique Segmental Muscles (plate XXIV, figures 13, 15, and 16) arise in the same region of the tergum as the tergo-pleurals but posterior to them. They slant caudad and ventrad to the suture fold of the succeeding segment and insert just in front of the Tergo-pleurals, and not far laterad from the edge of the Primary Longitudinal Sternals.

The Transverse Muscles: (Plate XXIV, figures 14 and 15)—

The Subintestinal Transverse Muscle (plate XXIV, figures 14 and 15) is very distinct and relatively stronger than in *Anax*. Its attachment is rather high above tergo-pleural suture of segment six near its anterior end.

The Muscular Diaphram (plate XXIV, figure 14) is like that of the Aeshnids in form but it is attached in the extreme anterior end of segment four. This places two whole segments instead of one between it and the Subintestinal Muscle. As it bows backward most of this distance, its contraction and flattening may be one of the causes of the gizzard being so often in the thorax.

*Morphology of Odonate Imagoes*

A great deal of attention has been paid to the thorax of the adult dragonfly, but very few references to abdominal structure can be found. Its general structure is of course included in such treatises as those of Calvert (1893) and Tillyard (1917); work upon the abdomen is otherwise scattered through special papers. Cuvier ("Le Regne Animal") as far back as 1834 figures the simpler internal structure of *Aeshna forcipata* Fab. Plateau (1884) has described briefly and figured the muscles of a few segments of *Agrion sanguincum* in his study of respiratory movements. Fenard in 1896 gave an account of the reproductive organs of *Libellula depressa* and reviewed the work of others on *Libellula* and *Aeshna*, and Marshall (1914) reworked the anatomy and histology of the digestive tract and reproductive organs of *Libellula quadrimaculata*.

The following work upon representatives of the subfamilies Agrioninae, Pseudostigmatinae, Aeshninae, and Libellulinae contains very little that is new beyond the study of many more types than have heretofore been used and the resulting material for comparison of variations. A dissection of the female of so elongated a form as *Megaloprepus coerulatus* should be of value in a discussion of the functions of the abdomen.

The dissection of the material was carried out about as with the larvae. Freshly killed specimens were used whenever the seasons permitted. At other times material in 70 per cent or 83 per cent alcohol was used. This greatly increased the difficulties which at best accompany the dissection of such slender forms as the Zygoptera: many specimens are required in such cases to assure the working out of the systems.

I. Zygoptera. Agrioninae, Pseudostigmatinae and Lestinae

*Calopteryx maculata* was here used (plate XXV) as the type and the other species dissected for comparison.

## The Alimentary Canal
(Plate XXV, figure 19)

This tract is almost perfectly straight and but little dilated in its various parts. Throughout its abdominal portion it is surrounded by a sheath of fatty tissue. When this is removed the following parts can be made out.

The Oesophagus is a slender tube throughout the prothorax and the greater part of the mesothorax. In the latter it turns ventrad and expands into the bulbous portion of the crop. A decrease occurs again in the posterior part of the metathorax and through the first four segments of the abdomen the crop is straight and of uniform diameter, about twice that of the oesophagus.

The Gizzard is in the first half of the sixth segment of the male of *Calopteryx* and the fifth in the female; in the middle of the sixth in *Megaloprepus* female. It seems alike in all cases: there is no dilation and the invagination of the ventriculus is slight. Miss Higgins (1901) notes some variation.

The Ventriculus is swollen moderately at the anterior end (segment five) and then falls to a uniform tube the size of that in the anterior abdominal segments. The Malpighian Tubules are received in the anterior part of the eighth segment in all species, they are neither numerous nor long.

The Ileum is dilated to egg-shape form, largest at the fore end, and possesses internally six longitudinal and irregular folds or ridges. It just passes the suture between segments eight and nine.

Here another enlargement, the rectum, begins. It continues through segments nine and ten, and is more oblong than the ileum though about the same size. In *Megaloprepus* especially it possesses three wide, white longitudinal thickenings with thin areas between; the rectum is also larger than the ileum. Near its end the rectum turns ventrad to the anus, a slit-like, bristly opening.

## The Reproductive System
(Plate XXV, figure 24)

Male:—The Testes of *Calopteryx* extend from the anterior part of segment seven to the end of eight. They lie dorso-laterally

and are pressed into triangular form by the rest of the organs. The vasa deferentia begin near the middle of the eighth segment and run directly to the region of segment nine where they gradually enlarge and after coiling around ventrally enlarge still more and connect with the central, round sperm sac. This sac opens beneath by the genital pore.

Female:—The Ovaries in *Calopteryx* run from the posterior metathorax as far as the posterior part of the eighth segment. They are attached to the thorax by a broad and diffuse dorsal ligament, and as far back as segment six they are close together. In segment seven they narrow to form the oviducts which pass through most of segment eight, turn ventrad and pass beneath the sides of the seventh ganglion (segment eight) to unite as they enter the oval bursa copulatrix. Beneath the posterior end of the bursa a short tube is produced; this immediately divides into two, each of which turns laterad and cephalad about the bursa. These accessory sacs are club-shaped and two-thirds the length of the latter. Two or more eggs seem able to pass down the oviduct at the same time.

In *Megaloprepus* the closely approximated ovaries begin in the posterior part of segment two and increase immediately to full width and size, and run caudad to the middle of segment six where they commence to separate and lie lower and laterally. Only in the posterior part of segment seven or in segment eight do they pass completely beneath the alimentary canal. Through segment eight they run parallel in the groove of the narrow V-shaped sternum, and unite only as they enter the bursa. The latter is oval and smaller than in *Calopteryx*. It is surrounded by much fatty matter within which are imbedded a number of small bent and coiled tubes that could not be clearly made out in the material available. Just anterior to the bursa is a flat tongue-shaped body the connections of which could not be made out. The two accessory sacs lie in the tenth segment pointing away from the bursa; they are heaviest at the anterior end. The eggs seem large, each ovary being but two eggs wide dorsally. They pass through the oviducts singly.

## The Nervous System
(Plate XXV, figures 18 and 23)

The nerve chain is normal. The ganglia are quite close to the front end of the segment as a rule (between the posterior sternal processes), and the connectives are slender and very close together. No marked variation was noted in *Megaloprepus*. In all forms the first abdominal ganglion is united with that of the metathorax; the double nature of this body can usually be easily seen.

## The Muscular System
(Plate XXV, figures 17, 20, 21, and 23)

The only figure of the abdominal muscles of the Zygopterous imago known to the writer is that of Plateau (1884), which shows one whole segment and parts of two others adjacent, of the right half of the abdomen. After an attempt to dissect these very slender forms his difficulties can be appreciated. He says, "La dissection des muscles abdominaux des Odonates est assez difficile et ne m'a bien réussi que pour l'Agrion sanguineum." His description is very brief.

The muscles of all groups are fewer, smaller and simpler in the imagoes than in the larvae. Except in the end segments the tergals are the only ones which are not minute.

Segmental Muscles of the Sternum: (Plate XXV, figures 17 and 23)—

A single pair of Longitudinal Sternal Muscles is located at the hind end of each segment except the first, ninth and tenth. In *Calopteryx* these decrease in length caudad, never being over one third of the length of the segment and usually much less. They are flat and thin, and are widest at their origin, an area near the point where the sternum narrows to form the sternellum. They insert upon the front of the succeeding sternite a short distance apart and between the anterior processes. They are widest at the insertion in some forms. These muscles are proportionately larger and stronger in the Zygoptera than in the Anisoptera. The females have the muscles of the second segment normal but strong; the males have them modified to aid in the movement of the penis.

Segmental Muscles of the Tergum: (Plate XXV, figures 17, 20, 21, and 23)—

As the tergum forms the largest part of the skeleton of each

segment and has dorsal, lateral, and ventral aspects, its muscles are largest and produce most of the movements.

The Superior Longitudinal Tergal Muscles (figures as above) are short band-like or fan-shaped muscles in pairs, one member on each side of the mid-dorsal line. In *Calopteryx* they are slightly separated; in *Megaloprepus* they interlock. The origin is upon the face of the tergum near its posterior end, the insertion upon the extreme anterior dorsum of the succeeding segment. They are wide enough to reach far ventrad on the sides of the tergum, almost or quite touching the Inferior Longitudinal Tergals.

The Inferior Longitudinal Tergal Muscles (plate XXV, figures 17, 21, and 23) are nearly twice as long as the superiors and are much thicker. They have a broad region of origin over the lateral and ventral portion of the tergite, becoming narrower at their insertion on the anterior corners of the tergum of the succeeding segment at the pleuro-tergal suture.

The Inferior Longitudinal Tergo-pleural Muscles. In the forms of Zygoptera dissected these muscles are not very distinct from the last named. They have the same origin but a different insertion, and are plainly separable in the second segment of female Zygoptera, and in all segments of the Aeshninae. It is probable that they have arisen by the migration of the point of insertion away from the tergum and toward the pleural region nearest the sternum; this places them beneath the anterior sternal process. It is conceivable, of course, that the evolution has been in the opposite direction, thus deriving the apparently single muscle of the most of the segments from the two. However, the presence of two muscles in the Aeshninae would point in the other direction. They are thin and weak and in the Libellulinae they are not present.

Longitudinal Thoracico-Abdominal Muscles:—

The Submedian Ventral Thoracico-Abdominal Muscles (plate XXV, figures 17 and 23, svta; plate XXVII, figures 31 and 36). A pair of very strong muscle bands which develop from, or replace, the sternals of the first segment. They attach to the abdomen on the anterior corners of the sternite of the second segment and to the thorax by a common tendon, the posterior epimeral apodeme.

The Lateral Thoracico-Abdominal Muscles (plate XXV, figures 17 and 23, lta). These originate on the furca of the metathorax and insert on the anterior end of the first sternite. They are heavy and widest at the anterior end.

The First Auxiliary Sterno-dorsal Muscles (plate XXV, figures 17 and 23, fasd) are cylindrical or spindle-shaped bands which originate on the posterior processes of the metathoracic furca and insert upon the anterior end of the first abdominal tergite.

The Second Auxiliary Sterno-dorsal Muscles are thinner bands. They have an origin similar to the above mentioned muscles but insert upon the anterior part of the second abdominal tergite.

Dorso-ventral Segmental Muscles:—

There is but one pair to each segment in Zygoptera.

The Anterior Dorso-ventral Muscles (plate XXV, figures 17 and 23, adv). These very small muscles pass vertically from their origin on the lower edge of the tergum up to the under side of the second sternal process.

The Tergo-Sternal Genital Muscles (Transverse Genitals of other authors) (plate XXV, figure 23, tsg). In *Calopteryx* the males possess two pairs of these in the second segment; one has its origin above and in front of that of the Inferior Longitudinal Tergal Muscle and its insertion upon the side of the sternum caudad of the origin of the Longitudinal Sternal. This may be the Inferior Longitudinal Tergo-Pleural with its insertion moved to the sternum and cephalad. The other has its origin just dorsal to and in front of the first, and its insertion on the face of the sternum anterior to the origin of the Longitudinal Sternal. It is of uniform diameter.

## II. Anisoptera. Aeshninae

All of the work of this section was done upon *Anax junius* and *Aeshna umbrosa*. The differences between the two were very few and slight: matters of size or minute variation in position.

### The Alimentary Canal

(Plate XXVI, figure 25)

After passing the occipital foramen the digestive tube expands suddenly several diameters. From the prothorax to the middle or posterior part of the metathorax the size of the oesophagus is

constant, and the tube is bowed upward. The remainder of the thorax, the first segment of the abdomen and a part of the second segment are filled by the large, oval crop which runs without interruption into the gizzard; this seems always to be in the second segment.

The Ventriculus is much distended at the region of the gizzard though not as large as the crop. Throughout the third, fourth, and fifth and most of the sixth segments the ventriculus is a straight tube but one-third or one-half the size of the oesophagus. In the posterior part of the sixth and anterior end of the seventh it enlarges a little, tapering quite suddenly to the region of the entrance of the Malpighian tubules.

The Ileum contained in the posterior end of the seventh segment is usually small in diameter, but the section occupying the whole of the eighth segment is much distended and possesses irregularly wrinkled walls. The strong sphincter muscle at its posterior end brings it to a point which projects, gizzard-like, into the rectum.

The Rectum is shorter and smaller than the ileum and occupies the most of the ninth and all of the tenth segments.

## Reproductive System

(Plate XXVI, figures 25 and 26)

Male.—The Testes are as usual long cylindrical bodies; they are here very dark in color, smooth of surface, and lie quite straight along the sides of the body between the anterior end of segment five and the anterior or middle part of segment eight.

The vasa deferentia are light in color, and run nearly straight caudad to the beginning of segment nine, tapering off a little. As they enter segment nine they begin enlarging again, and continue doing so until they join the sperm sac. Viewed from the side the form is often that of a reversed S. There is, however, considerable variation in the exact form.

The Sperm Sac is placed in the extreme anterior end of segment nine and is cordate in shape in dorsal view. It opens directly by the genital pore near the middle of the segment.

Female: (Also plate XXVII, figure 32.) In the ovipositing female the Ovaries are very large, filling all available space in the dorsal and lateral regions. They are attached to the posterior part of the thorax and immediately enlarge to fill the swollen

anterior segments of the abdomen. Beyond which they rapidly narrow and finally in the seventh segment blend into the oviducts.

The Oviducts are thus very short and quite wide, carrying several eggs (two or three) side by side. They meet on the under side of the bursa copulatrix. At the hind end of segment seven they pass beneath the diaphragm covering the neural sinus.

The Bursa Copulatrix varies in size depending upon its contents. It is oval or round, and is covered anteriorly by the last ganglion. Attached at its lower anterior part is a pair of finger-like accessory sacs which extend caudad about its sides. A ventral posterior extension of the bursa, a vagina, connects with the genital pore at the apex of the eighth segment.

In a small cup-like depression in the sternum of the ninth segment lie two elongated glandular or sac-like bodies. Their connections could not be made out clearly.

These descriptions were made from specimens taken during the period of active copulation in early April.

## Nervous System

(Plate XXVI, figure 25, nc.)

In the Anisoptera there is always a neural or sub-intestinal sinus formed in the concavity of the sternum by its being covered over by a sheet of membrane stretched between the tips of the sternal processes and along the pleural fold at the sides of the sternum. After the removal of the alimentary canal this membrane must be lifted away bit by bit before the nerve chain is bared.

The Nerve Chain in *Anax* and *Aeshna* is very similar to that of the Zygoptera. The ganglia are somewhat elongate and the connectives are thin and close together. Each ganglion lies about one third of the length of the segment from the anterior suture.

## The Muscular System

(Plate XXVII, figures 31, 33, 34, 35, and 36)

Both *Anax* and *Aeshna* have been carefully studied and compared. Their organization seems identical except for slight differences in the strength of the muscles. The general description of these species would also so nearly approach that of *Calopteryx* that it seems best to note only the larger differences.

A pair of well developed but slender Inferior Longitudinal Tergo-pleural Muscles (plate XXVII, figure 31, tp) is present in all segments from one to seven inclusive. As explained in the description of *Calopteryx* this muscle seems to have originated by the splitting off of the lower, or inner, part of the Inferior Longitudinal Tergal Muscle and the migration of the insertion to a point very close to the sternum upon the pleuron.

Segments two to eight have small Anterior Dorso-ventral Muscles (plate XXVII, figure 31, adv.) as seen in the Zygoptera. But in addition all the Anisoptera studied possess a second and larger pair in each segment from one to seven: the Posterior Dorso-ventral Muscles (plate XXVII, figure 31, pdv). These are larger band-like muscles connecting the posterior corners of the tergite with the sides of the sternum near its apex and just in front of the sternellum. No mention of these is to be found in the literature.

The details of the abdominal muscles in general can best be made out from the figures.

The sexes differ in the muscles of the segments occupied by the sex organs.

Second Segment (Plate XXVII, figures 31 and 36). In the males the two pairs of dorso-ventrals are present and especially well developed: the origin of the posterior pair is upon the transverse carina near the middle of the segment. As in *Calopteryx* there are two pairs of Tergo-Sternal Genital Muscles also having their origins upon the carina but just above that of the last named muscle. The muscles of this segment of the females are normal.

Eighth and Ninth Segments. The eighth segment of males possesses very short and wide but weak sternals, two pairs of lateral tergals, and normal superior tergals. In the ninth segment the sternals of the male are very small (perhaps absent) and lie laterad to the genital pore. A very short, strong muscle, (trs) a Transverse Sternal connects transversely the internal processes of the valves that close the genital pore, and lies between the anterior ends of the sternals. The ninth segment

also contains two pairs of inferior tergals as in the preceding segment.

In the females the eighth and ninth segments have a pair of muscles not necessary in the males: the Transverse Genitals of the eighth segment (tsg–8).

### III. Anisoptera. Libellulinae

Specimens of several species (*Libellula pulchella, Plathemis lydia, Erythemis simplicicollis, Perithemis domitia,* and *Tramea carolina*) were dissected. Many of these are figured below and the comparisons between these genera can best be made by a study of the figures. In essential details they are almost alike, and also very similar to the Aeshnids. No attempt will be made to describe them. A few contrasts may, however, be pointed out.

With the shortening and widening of the body the internal organs change in proportion. The nerve ganglia are rounder, the connectives heavier and farther apart; the alimentary canal has a greater diameter but its parts are located as usual; the reproductive organs are the same except perhaps for more direct oviducts and vasa deferentia; and the muscles are wider and flatter.

Figures 37 and 38 of *Tramea carolina* were drawn from an advanced teneral specimen which had not as yet taken food. The distended crop and ventriculus will be noted. They are filled with gas, in all probability air. The same figure also shows the immature condition of the ovaries, scarcely more advanced than those of the larva. The nymphs of the Zygoptera, especially, have much more mature gonads than these seem to be.

### SUMMARY OF COMPARATIVE MORPHOLOGY

A comparison of the anatomy of the systems studied in these three important groups of Odonata shows clearly the fact that the larva and the imago have in each case followed distinct and different lines of specialization. In successively higher groups the structures of the larva become more intricately adapted for aquatic existence, while in the imagoes the two higher groups are very much better fitted for flight and aerial existence than are the Zygoptera.

Such lines of modification would naturally affect the structure of certain systems more than others: the digestive tract, the tracheal system, and the muscles. The reproductive organs in their growth through larval and adult stages are apparently as unaffected as though they had not existed in an animal possessed of a hemimetabolic life cycle. So also it may be said of the nerve chain, that it is changed in but very minor ways during growth and metamorphosis; considerable stretching out of the connectives, and some consolidation of the pairs of ganglia. The nerves and their branches must of course be modified to meet the simpler muscular and other structures of the adult.

The most profound changes then are to be seen in the alimentary canal, the muscles, and the tracheae. The last we cannot discuss here.

In the alimentary canal of the nymphs there are but two marked variations:

1. The nature and position of the gizzard. In structure it is always possessed of an armature, but this varies with the group (See Higgins, 1901). Its normal position is near the second or third abdominal segment, but a great deal of variation is found and is probably due to functional condition. The anterior end of the rectum and the beginning of the oesophagus are held firmly to their places but the digestive tube between is quite free to move forward or backward between the thorax and the sixth segment. This is even more true of the Zygoptera than of the Anisoptera.

2. The modification of the rectum to function as a respiratory organ in the Anisoptera. The remarkable enlargement of the rectum and its development of a highly complex tracheal supply make this organ one unique in the anatomy of the alimentary canal. As the Zygoptera do not possess this condition there is a great contrast between the two groups.

A comparison of the figures of the muscles of the three groups of larvae will show:

1. That all Odonate larvae have this system strongly developed.

2. That in the Zygoptera the muscles are arranged over nearly the whole inner wall of the tubular body. The longitudinal muscles greatly predominate.

3. That the differentiation into tergal and sternal groups of muscles is carried farthest in the Libellulinae, and that the Aeshninae stand intermediate in this respect.

4. That the greatest complexity both in numbers and in interrelations is found in the Aeshninae. The Zygopterous forms and the Libellulinae are similar in their simpler sets of tergal and sternal muscles.

5. That the dorso-ventral or "respiratory" muscles are much stronger and more complex in the Anisoptera where the body form becomes more and more flattened.

These conditions should be contrasted with those of the imagoes:

The alimentary canal is simplified by the reduction of the larval structures.

1. The armature of the gizzard is largely lost, but its position has changed little in metamorphosis; in the Anisoptera it is near the second segment, in the Zygoptera, near the fifth and sixth.

2. The hind gut is greatly simplified, due to the loss of the respiratory function.

A comparison of the muscles of the imagoes of the three groups will show:

1. That they are very constant in structure considering the great variations in the external form of the abdomen.

2. That most of the differences present are quantitative.

3. That the chief qualitative variation is the presence of a pair of Posterior Dorso-ventral Muscles in each segment of the Anisoptera; this is absent in Zygoptera.

4. That the Aeshninae and Zygoptera possess Inferior Longitudinal Tergo-pleural Muscles not found in the Libellulinae.

5. That the sternal muscles of the Zygoptera are much better developed than those of the Anisoptera.

6. That in both the Zygoptera and Anisoptera there is great disparity between the tergal and sternal muscles. The Inferior Tergals replace in function the atrophied sternals of the Anisoptera.

No systematic attempt can be made at this time to homologize the muscles of larva and imago. So many muscles are lost during metamorphosis and the remaining ones are so changed

in size and position that the question of their origin remains obscure. The most marked changes are:

1. Reduction in the number of muscles.
2. Reduction in the size of nearly all muscles.
3. The development of new muscles connected with the reproductive organs. These must develop during or after metamorphosis as full grown larvae show no distinct beginnings.

### Abdominal Modifications as Adaptations

When the anatomical conditions described above are gone over in an effort to relate them to the functions of the abdomen it is quite clear that the structures of the larva are direct adaptations to the primary functions. In form the abdomen is adapted to wriggling (Zygoptera) or darting (Anisoptera) through the water; the large digestive tract with its extensive dilations and gizzard armature is very well fitted to the feeding habits of a voracious larva; the rectal gills of Anisoptera together with the extensive tracheal system permeating the whole body is undoubtedly a mechanism developed to meet the respiratory needs of active aquatic larvae; and all the muscle systems are directly related to certain evident functions. The muscular differences between the Zygoptera and the Anisoptera are perhaps greater than any others, but it would seem that the tubular arrangement and longitudinal direction of the muscles in the Zygopterous larva were perfected for locomotion by wriggling from side to side, and this is practically the only means of swimming they possess. The development of the dorso-ventral muscles in increasing degree becomes evident in the Anisoptera, where the larvae are dorso-ventrally compressed, and here the spacious rectal chamber or branchial basket is frequently filled with water and suddenly and vigorously emptied, the force of the ejected water being used for locomotion by darting.

In the imagoes many of the structures are clearly fitted to particular uses, though they are quite changed from the status of the larva. However, certain of the conditions following transformation are not so clear, and of these the most important are the great elongation of the abdomen, its variation from a cylindrical form in the Zygoptera to flattened in the Libellulinae, the

remarkable swelling or constriction of certain parts in many groups, and the great reduction of the muscles, especially the sternal muscles. Some of these problems have been discussed in the introductory pages of this paper. It seems probable that most of these variations are correlated with the elongation of the abdomen.

The writer thinks that we cannot explain the nature of these modifications, or even decide whether they are adaptive or not, without much more knowledge than that set forth in the section on comparative anatomy. A great deal of field study of the exact mode of functioning of the parts above described is necessary before valid conclusions can be drawn. And in order to bring out clearly the nature of the problems, a preliminary view of the main adaptive possibilities is added below.

1. *Flight.* The dragonflies (Anisoptera) are probably the most expert of fliers: powerful, quick and exact of manipulation, and tireless. The damselflies (Zygoptera) are much weaker. Several distinct modes of flight are seen in the different groups; fluttering or sculling in the Zygoptera, darting in the Aeshninae, and soaring or skimming in the Libellulinae. Thus far we do not know the mechanical principles involved in each of these modes, and but very little of the general principles having to do with elongation of the abdomen and proportions of the thorax. Such studies of flight as those of Amans (1883–84, 1885) and Needham (1903) though carefully done include but little beyond the structure of the wings and thorax. Hankin (1913, chapter XX) has dealt with the purely observational side of the question.

The elongation of the abdomen may be related to flight in several ways:

(1) In controlling the position of the center of gravity. In his investigation of the center of gravity in insects Plateau (1872) long ago showed that this point is in the vertical median plane through the long axis of the body, that it is the same for all members of each species though different for the two sexes, that it is not determined by the external form of the body, that at metamorphosis the relative center of gravity approaches the head, that in standing the center of gravity is placed at the base of the abdomen or in the metathorax, that in walking there is but slight

displacement, that there is no displacement of the center when the insect passes from repose to flight and that a very slight oscillation occurs during flight. In aquatic insects the center of gravity is nearer the lower than the upper surface of the body and a slight oscillation occurs during natation. He also used the Odonata to illustrate his discoveries: in *Agrion* the center of gravity is in the first third of the third abdominal segment, in *Aeshna* in the middle of the second segment, in *Cordulia* on the posterior margin of the metathorax, and in *Libellula* between the metathorax and the first abdominal segment. It would seem that we might safely infer that stability would be greater in forms having the center of gravity a little back of the wing center; this is true of dragonflies.

(2) In the production of a rudder. Hankin has suggested that the wings of dragonflies are used in steering the body to right and left and in keeping the horizontal position. This seems the probable mechanism as there is little freedom of movement to the sides in the abdomen. Ascent or descent, however, must be affected by the position of the abdomen. Again Hankin noticed that the abdomen of *Pantala* was allowed to droop under conditions of easy flight but was straightened out or even elevated under more difficult air conditions. In this connection the greatly flattened abdomen of the higher Libellulinae and the expanded tip in the Gomphinae must be taken into account. Either form should furnish an excellent rudder.

(3) In Modifying the Contour:

That excellence in flight is dependent upon the relation of abdomen to thorax may be inferred from the table on page 387. The thoracic equipment of wings and muscles is very necessary but the length and nature of the abdomen are just as important though more passive factors in successful flight. The rapid development and present importance of the monoplane for war purposes should act as evidence in this direction.

Some of the most marked improvements in the aeroplane during the past three or four years (Lefranc, 1918) have to do with that portion of the mechanism that corresponds to and resembles in appearance the abdomen of the dragonfly: the enclosure of the body, the production of a very smooth surface,

the gradual tapering of the anterior into the posterior portions of the body, the development of rudder expansions laterally on the posterior end of the body. All these not only remind one of, but actually reproduce for him, the bodies of the Aeshninae and Gomphinae. That length alone is not the only factor is easily seen here and it is just as clearly illustrated in the Zygoptera with their weak thorax, proportionately large wing surface, and long slender abdomen with no basal enlargement.

·2. *Copulation and Oviposition.* A review of Calvert s suggestion that the elongated abdomen of certain Pseudostigmatinae is an adaptation to oviposition was given in the early part of this paper. During the purely anatomical investigation following, no light has appeared upon it. Some illustrations selected from the table of comparative measurements (page 387), however, may be of use. The genus *Lestes* is well represented there. So far as the writer has observed all the species named have the same general habit of oviposition—that of burying the eggs in the tissues of plants growing in or near the water. As many as a half dozen of these species have been taken on the same day ovipositing in the same place and upon the same plants. It was impossible to see that the longer bodied species, as *L. rectangularis*, *vigilax*, and *eurinus*, possessed any advantage over the shorter forms. None of them of course had the habits of *Mecistogaster*.

But, granted that the longer forms did possess some advantage in this line, why should the males of these species be so much longer than the females? They could scarcely find a special use for so long an abdomen even though they did accompany the female, grasping her as many do, during oviposition. Dr. Calvert suggests that the male must be elongate if the female is so to meet the necessities of copulation, but he gives no explanation for a male having a length of 42 mm. when the female is but 32 mm. as in the case of *L. rectangularis*. It seems very probable that *Mecistogaster* uses her long abdomen to advantage in the way suggested, but that does not mean that the elongated abdomen is an adaptive variation.

In cases where the male accompanies and holds the female as she lays her eggs the expectation would be that the male abdomen

would be as stout as possible. But in the Zygoptera the males are almost invariably not only longer but more slender. The latter peculiarity could be accounted for especially as there seems to be no difference in the size of the muscles of the two sexes, by the presence of the large ovaries in the female, but there is no explanation thus far for excess of length in the male. It will be seen from the figures that the sternal muscles of the Zygoptera and the Aeshninae, in which copulation occurs during flight and the male retains his hold during oviposition, are relatively stronger than in the Libellulinae. The lifting of the female, who is often passive, during the transfer of sperm capsules from the ninth segment to the copulative organs of the male on the second segment, possibly requires stronger sternal and inferior tergal muscles. (See Wesenberg-Lund, page 204.)

3. *Respiration*. As a final suggestion, it may be said that the elongated form may have some value in the respiratory processes of so exceedingly active an insect as the adult dragonfly. No part of the internal structures is far from the great tracheal trunks. Numerous air sacs and spaces are to be found, though they have not been worked out, in the ends and dorsal regions of the abdomen (plate XXV, figure 24). Packard (1898) states that such sacs are reservoirs for the storage of air for respiration and that they do not aid in flight and the buoyancy of the body. Regarding these matters there is still room for difference of opinion, but these sacs certainly bear some vital relation to the life of the dragonfly.

After all the present evidence has been collected it is perfectly clear that the general question of the adaptation of the abdomen in various groups and in the sexes can only be solved, if at all, by very close studies of a large number of species in the field representing different groups and especially different habits and life activities. The anatomical features set forth in this paper may then be applied. It is not unlikely that such study will also involve insects of other groups, as marked cases of abdominal elongation are to be seen in many representatives of the orders Hymenoptera, the Neuroptera (*Myrmeleon*, etc.), the Diptera (*Tipula*, the Asilidae, etc.), and some others. In some of these there is a most remarkable difference in the sizes of the sexes.

## Bibliography

Amans, P. 1881. "Recherches Anatomiques et Physiologiques sur la Larve de l'Aeshna grandis." Revue des Sciences Naturelles, (3), I, pp. 63 to 74, pl. II. Montpellier.

1883–1884. "Essai sur le vol des Insects." Rev. des Sc. Nat., (3), II and III. Montpellier.

1885. "Comparaisons des organes de vol dans la serie animale." Ann. des Sc. Nat. Zool., (6), XIX, pp. 9 to 222, pls. I to VIII.

Backhoff, P. 1910. "Die Entwicklung des Copulationsapparates von Agrion." Zeitschrift für Wissenschaftliche Zoologie, XCV, pp. 647 to 706, taf. XXI.

Calvert, P. P. 1893. "Catalogue of the Odonata of the Vicinity of Philadelphia, with an introduction to the study of this group of insects." Trans. Amer. Ent. Soc., XX, no. 3, pp. 153 to 268, pls. II and III.

1899. "Odonata from Tepic, Mexico." Proc. Calif. Acad., (3), I, p. 410. Also 1903. "Ganglia of Odonata." Proc. Acad. Nat. Sci. Phila., 1903, p. 760.

1901–1908. "Biologia Centrali-Americana. Odonata." pp. 17 to 420, 9 pls. London.

1911–1915. "Studies on Costa Rican Odonata." Ent. News, Phila.

1911. I. "The larva of *Cora*." Vol. XXII.

1911. II. "The Habits of the Plant-dwelling Larva of *Mecistogaster modestus*." Vol. XXII.

1911. III. "Structure and Transformation of the Larva of *Mecistogaster modestus*." Vol. XXII.

1915. VII. "The Waterfall Dwellers: Thaumatoneura. Internal Organs of Larva and the Respiration and Rectal Tracheation of Zygopterous Larvae in General." Vol. XXVI, pp. 385 to 395, pls. XV to XVII, and pp. 435 to 447.

Calvert, A. S. and P. P. 1917. "A Year of Costa Rican Natural History." Chapter XIII, pp. 230 to 243. Macmillan Co.

Carroll, Mitchel. 1918. "The Rectal Tracheation and Rectal Respiration of the Larvae of Odonata Zygoptera. III. "The Hind Gut, Abdominal Tracheae, and Rectal Respiration in the Larva of *Mecistogaster modestus* from Costa Rica." Proc. Acad. Nat. Sci. Phila., 1918, pp. 86 to 103, 6 text figs.

Cullen, Anna M. 1918. "The Rectal Tracheation and Rectal Respiration of the larvae of Odonata Zygoptera. I. "Rectal Tracheation of Argia putrida Larva." Proc. Acad. Nat. Sci. Phila., 1918, pp. 75 to 81.

Cuvier, Georges. 1836–1846. "Le Regne Animal, Les Insectes." Plate 100.

Dufour, Leon M. 1852. "Etudes Anatomiques et Physiologiques, et Observations sur les Larves des Libellules." Ann. des Sci. Nat., (3), Zool., XVII, pp. 65 to 110, pls. III to V.

Fenard, A. 1896. "Recherches sur les Organes complémentaires Internes de L'Appareil Génital des Orthoptères." Bull. Sci. France et Belg., XXIX, pp. 506 to 512; 515.

Garman, Philip. 1917. "The Zygoptera of Illinois." Bull. Ill. State Lab. Nat. Hist., Urbana, XII, art. IV.

Hankin, E. H. 1913. "Animal Flight." Especially Chapter XX, pp. 363 to 393. London.

Higgins, Helen T. 1901. "The Development and Comparative Structure of the Gizzard in the Odonata Zygoptera." Proc. Acad. Nat. Sci. Phila., 1901, pp. 126 to 141, pls. II to IV.

Lefranc, Jean-Abel. 1918. "L'Evolution de L'Aviation. Allemande. I. Avions." La Nature, 9 Fevrier.

Marshall, Wm. S. 1914. "On the Anatomy of the Dragonfly." Trans. Wisc. Acad. Sci., XVII, pp. 755 to 790, pls. LXVIII to LXXI.

Matula, J. 1911. "Untersuchungen über die Funktion des Zentralnervensystems bei Insekten." Pflüger's Archiv f. die Gesammte Physiologie, Bd. 138, pp. 390 to 391.

Muttkowski, Richard A. 1910. "Catalogue of the Odonata of North America." Bull. Milwaukee Pub. Mus., I, art. I.

1911. "Studies in Tetragoneuria." Bull. Wisc. Nat. Hist. Soc., IX, no. 3.

Needham, J. G. 1903. "Life Histories of Odonata." Bull. N. Y. Mus., LXVIII, pp. 218 to 279, pl. II.

1903. "A Genealogical Study of Dragonfly Wing Venation." Proc. U. S. Nat. Mus., XXVI, pp. 703 to 764, pls. XXXL to LIV.

Packard, A. S. 1898. "A Textbook of Entomology." Macmillan Co.

Pierre, l'Abbé. 1902. "Sur la Ponte d'un Neuroptere Cecidozoon Lestes viridis." Revue Sci. du Bourbonnais et Centre de France, XV, pp. 181 to 194.

1904. "L'Eclosion des Œufs de Lestes viridis." Ann. Soc. Ent. France, LXXIII, pp. 477 to 484, 1 pl.

1908. 1909. "Étude sur la Ponte des Odonates." Revue Sci. Bourbonnais et Centre de la France, pp. 1 to 38.

Plateau, Félix. 1872. "Experimental Researches upon the Position of the Center of Gravity in Insects." Ann. and Mag. Nat. Hist., (4), X, pp. 55 to 57.

1884. "Recherches sur les Mouvements Respiratoires des Insectes." Mem. Acad. Royal Belg., XLV, pp. 111 to 123, text figs.

Portier, P. 1911. "Recherches Physiologique sur les Insectes Aquatic." Arch. Zool. Exp. Gen., (V), VIII, pp. 89 to 379, 1 pls.

Sadones, J. 1896. "L'appareil Digestif et Respiratoire des Odonates." La Cellule, XI.

Scott, G. G. 1905. "Distribution of the Tracheae in the Nymph of Plathemis lydia." Biological Bulletin, IX, no. 6, pp. 341 to 351.

Tillyard, R. J. 1917. "The Biology of Dragonflies." Cambridge Uni. Press.

Viallanes, H. 1884. "Anatomie et Dissection de la Larve de la Libellule." Feuille des Jeunes Naturalistes, XIV, pp. 81 to 87, pl. II.

Walker, E. M. 1912. "The North American Dragonflies of the Genus Aeshna." Uni. of Toronto Studies, Biol. Ser., pp. 1 to 213, pls. 28.

1914. "The Known Nymphs of the Canadian Species of Lestes." Can. Ent., XLVI, no. 6, pp. 189 to 200.

1914. "New and Little Known Nymphs of Canadian Odonata." Can. Ent., XLVI, pp. 349 to 357.

Wallengren, Hans. 1914. "Physiologisch-Biologische Studien über die Atmung bei den Arthropoden. II. Die Mechanik der Atembewenungen bei Aeschnalarven." Lunds Universitets Arrskrift. N. F., afd. 2, Bd. X, no. 4, pp. 1 to 24, 1 pl. and figs.

Wesenberg-Lund, C. 1913. "Odonaten Studien." Internationale Rev. der gesamten Hydrobiologie und Hydrographie, pp. 155 to 228; 373 to 422.

Whedon, A. D. 1914. "Preliminary Notes on the Odonata of Southern Minnesota." Minn. State Ent. Rept., pp. 77 to 103, 10 photographs.

Williamson, E. B. 1905. "Oviposition in Tetragoneuria." Ent. News, XVI, pp. 255 to 256.

and Calvert, P. P. 1906. "Copulation in Odonata." Ent. News, XVII, pp. 143 to 150.

1909. "The North American Dragonflies of the Genus Macromia." Proc. U. S. Nat. Mus., XXXVII, pp. 369 to 389, pls. 35 and 36.

1916. "Directions for Collecting and Preserving Specimens of Dragonflies for Museum purposes." Misc. Pub. of Mus. Zool. Mich. Uni., pp. 15.

## *Abbreviations Used in Plates XXI–XXIX*

ada = adductor muscle of dorsal appendages.
adv = anterior dorso-ventral muscle.
agln 1, 2, 3, 4, etc. = abdominal ganglia.
al = alimentary canal.
ala = adductor of lateral appendage.
am = pre-rectal ampulla.
ap = anterior processes of sternum.
as = air space.
astd I = first auxiliary sterno-dorsal muscle.
astd II = second auxiliary sterno-dorsal muscle.
bc = bursa copulatrix (seminal receptacle).
brb = branchial basket.
car = carina.
cn = connectives.
cr = crop.
ddr = dorsal dilators of rectum.
di = muscular diaphragm.
dtr = dorsal tracheal trunk.
dv = dorso-ventral segmental muscles.
dva = dorso-ventral segmental muscles, anterior part.
dvm = dorso-ventral segmental muscles, middle part.
dvp = dorso-ventral segmental muscles, posterior part.
dvo = dorso-ventral oblique segmental muscles.
dvtp = dorso-ventral tergo pleural muscles of tramea.
dvts = dorso-ventral tergo sternal muscles of tramea.
fasd = first auxiliary sterno-dorsal muscles.
gn = gonapophyses.
gon = gonads.
gp = genital pore.
gz = gizzard.
h = heart.
hg = hind gut.
il = small intestine (ileum).
inlt = inferior longitudinal tergal muscle.
itls = internal tertiary longitudinal sternal muscle.
lap = lateral abdominal appendage.
lpsp = lateral primary longitudinal sterno-pleural muscle.
ls = longitudinal sternal muscle.
lsta = lateral sternal thoracico-abdominal muscle.
lstah = posterior portion of lateral sternal thoracico-abdominal muscle.
lta = lateral thoracico-abdominal muscle.
mg = midgut (or ventriculus).
mpt = malpighian tubules.
nc = nerve cord.
oe = oesophagus.

od = oviduct.
ov = ovary.
pdv = posterior dorso-ventral muscle.
pn = pleuron.
pls = primary longitudinal sternal muscle.
plsthabd = posterior part sternal thoracico-abdominal muscles.
plt = primary longitudinal tergal muscle.
pp = posterior processes of sternum.
qls = quaternary longitudinal sternal muscle.
qlt = quaternary longitudinal tergal muscle.
qnlt = quinary longitudinal tergal muscle.
rt = rectum.
sp = spiracle.
sls = secondary longitudinal sternal muscle.
slt = secondary longitudinal tergal muscle.
spls = sterno pleural suture.
sps = sperm sac.
st = sternum.
str = subintestinal transverse muscle.
sult = superior longitudinal tergal muscle.
svta = sub-median ventral thoracico-abdominal muscles.
sxlt = sextic longitudinal tergal muscle.
t = testes.
tg = tergum.
tgln 1 = first thoracic ganglion.
tgln 2 = second thoracic ganglion.
tls = tertiary longitudinal sternal muscle.
tlt = tertiary longitudinal tergal muscle.
tp = tergo-pleural muscles.
tpls = tergo-pleural suture.
trcar = transverse carina.
trs = transverse sternal muscle.
ts = tergo-sternal muscles.
tsg = tergo-sternal genitals.
vab = (median) ventral thoracico-abdominal muscle.
vad = ventral adductor muscles of lateral appendages.
vdrt = ventral dilator muscles of the rectum.
vds = vas deferens.
ves = vestibule.
vra = ventral retractor muscles of the anus.
vs = visceral sheath.
vsta = ventral sternal thoracico-abdominal muscle.
vstr = visceral tracheal trunk.
vtr = ventral tracheal trunk.

## EXPLANATION OF PLATES

All figures drawn to measurement or under the camera lucida by the author.

### Plate XXI

Structure of the Larvae: Zygoptera

Fig. 1.—*Lestes unguiculatus* ♂ opened dorsally and spread out, showing the muscular, nervous, digestive and respiratory systems. (× 8)

Fig. 2.—*Lestes unguiculatus* ♀ showing the visceral sheath, part of the digestive tract and the ovaries in dorsal view. (× 8)

Fig. 3.—*Lestes unguiculatus:* dorsal view of the male reproductive organs of the full grown larva. (× 8)

Fig. 4.—*Hetaerina americana*, showing the muscles of the left side of the first three segments. (× 8)

### Plate XXII

Structure of the larvae: Aeshnidae and Libellulidae

Fig. 5.—*Anax junius* ♂ with dorsum removed to show the main tracheae and the digestive tract. Parts covered by others are indicated in dotted lines. (× 4)

Fig. 6.—*Anax junius* ♂ showing a lateral view of segments five to nine: alimentary canal, dorsal tracheal trunk, transverse muscles, and reproductive organs of the right side. (× 4)

Fig. 7.—*Sympetrum vicinum:* half grown larva sectioned longitudinally to show the complete course of the alimentary canal. (× 7)

### Plate XXIII

Structure of the larvae: Aeshnidae

Fig. 8.—*Anax junius* ♀ with dorsum removed to show the nervous and muscular systems. Most of the muscles of the left side have been dissected away to show the smaller sets. (× 4)

Fig. 9.—*Anax junius* ♀. A cross section of segment six, viewed from the posterior end and showing especially the relations between the various sets of muscles, the alimentary canal, and the main tracheae. Camera lucida. (× 4)

Fig. 10.—*Anax junius* ♀. Longitudinal section showing the muscles of the right side, segments five, six and seven. Camera lucida. (× 4)

Fig. 11.—*Anax junius* ♀. The tergum removed from the specimen figured in 8, showing the muscles and heart. The larger muscles have, also, been dissected off to expose the smaller ones lying dorsally. (× 4)

Fig. 12.—*Anax junius.* A diagram to indicate the relative positions of the sternal muscles.

## Plate XXIV

Structure of the larvae: Libellulidae

Fig. 13.—*Tramea carolina* ♀. Sternal muscles, dorso-ventral muscles, the subintestinal transverse muscle, and the nerve cord. (× 5)

Fig. 14.—*Tramea carolina* ♀. Dorsal view of the alimentary canal and transverse muscles. (× 5)

Fig. 15.—*Tramea carolina*. Lateral and dorsal muscles of the left side as seen through the transparent skeleton, segments four to eight. (× 5)

Fig. 16.—*Tramea carolina* ♀. Tergum of the specimen used in fig. 13 showing the tergal muscles and the heart. (× 5)

## Plate XXV

Structure of the imagoes: Zygoptera

Fig. 17.—*Megaloprepus coerulatus* ♀, the first three segments split along the mid-dorsal line and spread out showing the muscles. (× 4)

Fig. 18.—*Megaloprepus coerulatus* ♀: the nerve cord removed and laid to one side, the ganglia being at their normal level. (× 4)

Fig. 19.—*Calopteryx maculata* ♂. A lateral view of the alimentary canal. (× 4)

Fig. 20.—*Calopteryx maculata* ♂. The superior tergal muscles of the fourth and fifth segments. (× 4)

Fig. 21.—*Calopteryx maculata* ♂. The superior and inferior tergal muscles of the right side of segment four. (× 4)

Fig. 22.—*Calopteryx maculata* ♀ larva. The posterior part of the alimentary canal showing the regions from the mid gut to the anus. (× 8)

Fig. 23.—*Calopteryx maculata* ♂. Ventral half of the abdomen (dorsum removed) showing the muscles and nerve cord. (× 4)

Fig. 24.—*Lestes unguiculatus* ♀. The tip of the abdomen split into right and left halves showing internal organs, and air spaces. (× 4)

## Plate XXVI

Structure of the imagoes: Aeshnidae and Gomphidae

Fig. 25.—*Anax junius* ♀ split dorsally and spread out: reproductive organs, nerve cord, and alimentary canal (in dotted outline). (× 2)

Fig. 26.—*Anax junius* ♂. Reproductive organs. (× 2)

Fig. 27.—*Hagenius brevistylus* ♀. Dorsal view of abdomen. (× 2)

Fig. 28.—*Hagenius brevistylus* ♂. Lateral view of abdomen. (× 2)

Fig. 29.—*Hagenius brevistylus* ♂. Dorsal view of abdominal tip. (× 2) (nearly).

Fig. 30.—*Hagenius brevistylus* ♂ larva. Ventral view of abdomen. (× 2) (nearly).

## Plate XXVII

Structure of the imagoes: Aeshnidae

Fig. 31.—*Anax junius* ♀ opened dorsally and spread, exposing the muscles (alimentary canal and nerve cord removed). (× 2½)

Fig. 32.—*Anax junius* ♀. The right half of the abdominal tip containing the viscera, segments seven to ten. Camera lucida. (× 4)

Fig. 33.—*Aeshna umbrosa* ♂. Muscles of the fifth segment. Camera lucida. (× 4)

Fig. 34.—*Anax junius* ♀. Muscles of fifth segment. Camera lucida. (× 4)

Fig. 35.—*Anax junius* ♂. Muscles of fifth segment. Camera lucida. (× 4)

Fig. 36.—*Aeshna umbrosa* ♂. Segments one and two opened dorsally exposing the muscles of the copulatory organs. Camera lucida. (× 3½)

## Plate XXVIII

Structure of the imagoes: Libellulidae

Fig. 37.—*Tramea carolina* ♀ teneral. Specimen opened dorsally and spread out, and the viscera removed, exposing the muscles and nerve cord. (× 4)

Fig. 38.—*Tramea carolina* ♀ teneral. The alimentary canal of the same specimen as used above. Note its inflated condition. (× 4)

## Plate XXIX

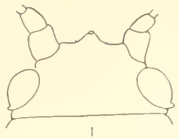
Structure of the imagoes: Libellulidae

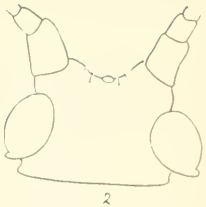
Fig. 39.—*Libellula pulchella* ♂. Tergum and viscera removed leaving the muscles below and the reproductive organs. (× 4)

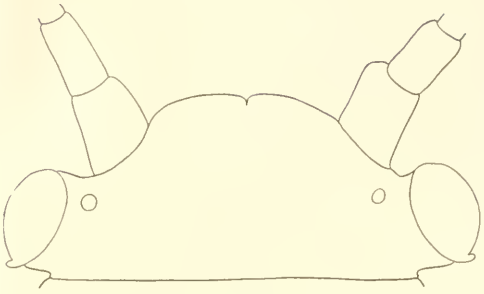
Fig. 40.—*Libellula pulchella* ♂. Tergum of above. (× 4)

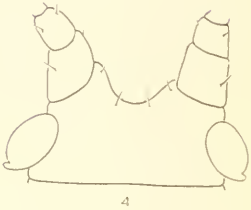
Fig. 41.—*Libellula pulchella* ♀. Part of the reproductive organs, in the eighth segment. (× 4)

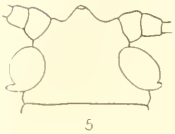
Fig. 42.—*Perithemis domitia* ♂, with the tergum removed to show the muscles of segments four, five and six. (× 8)

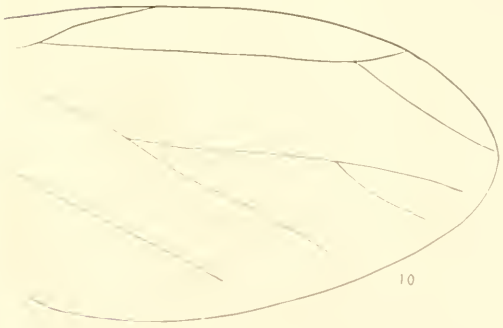


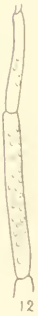



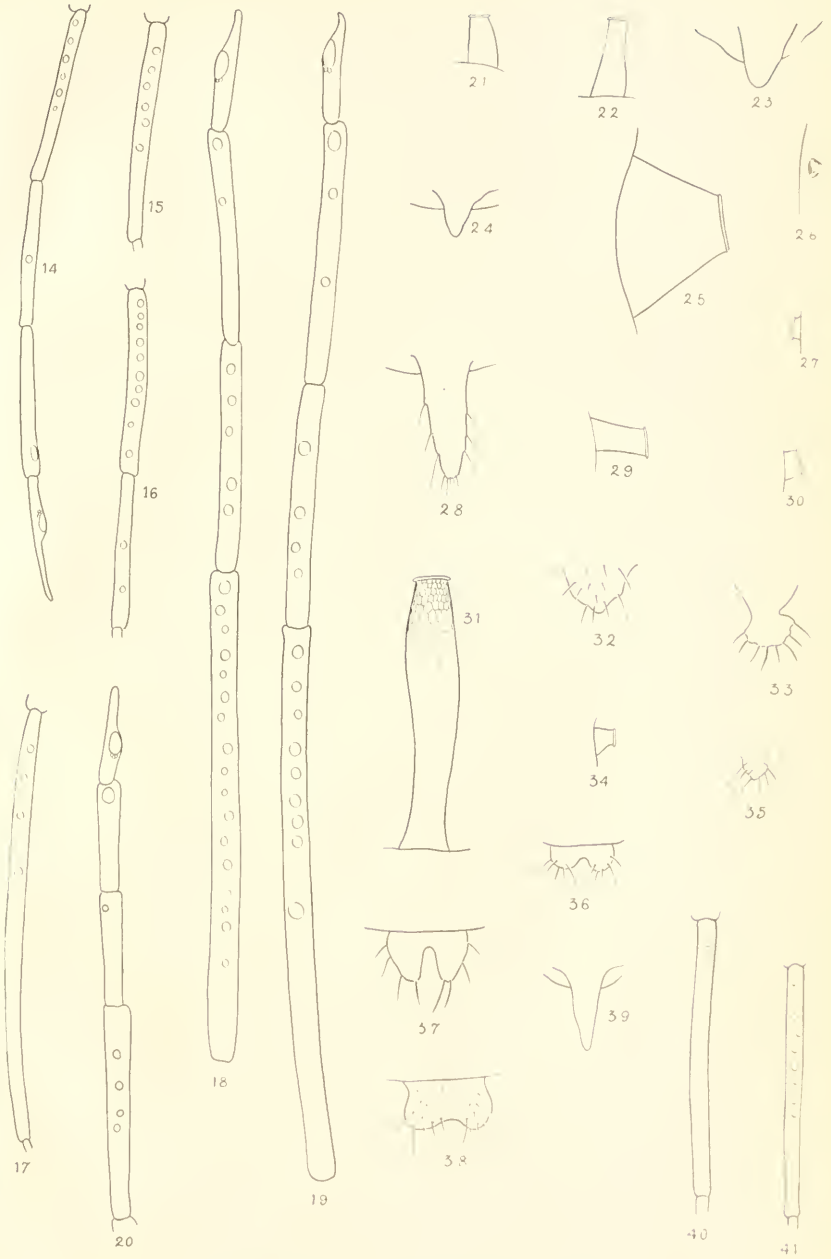



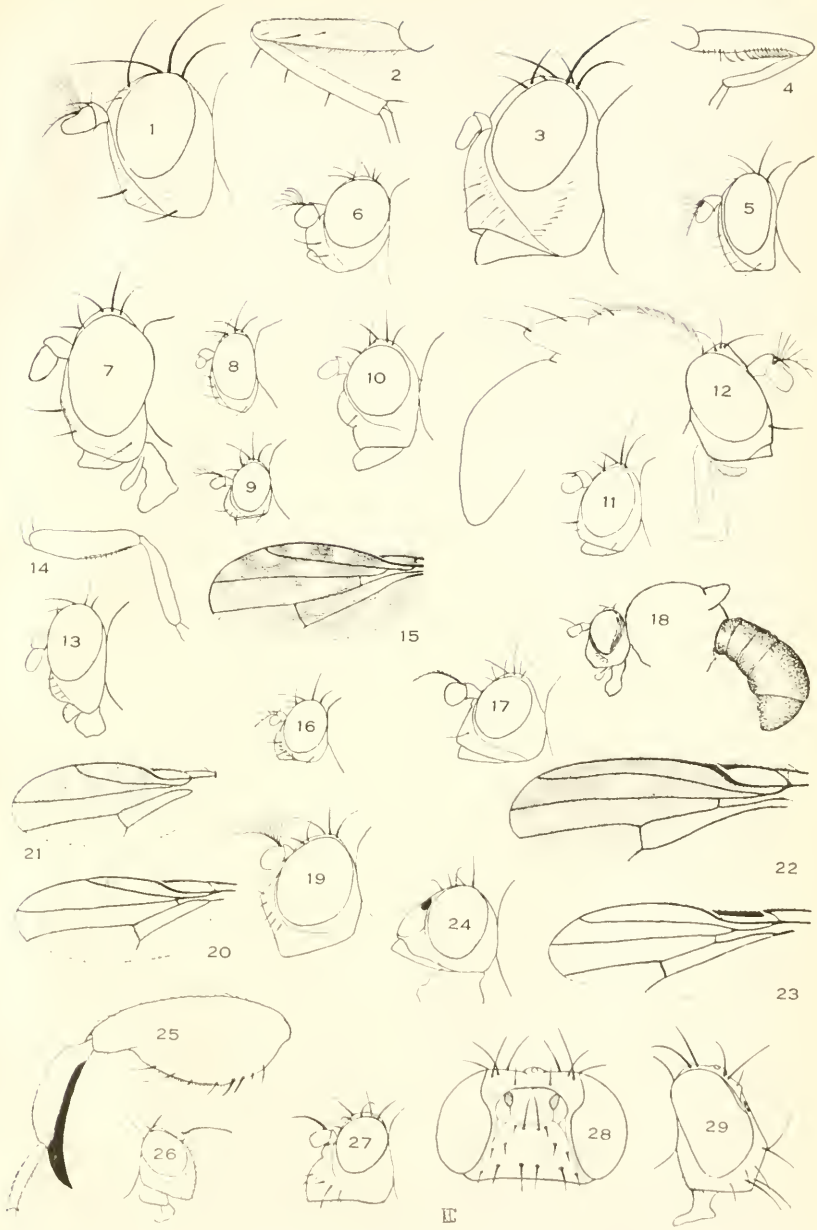




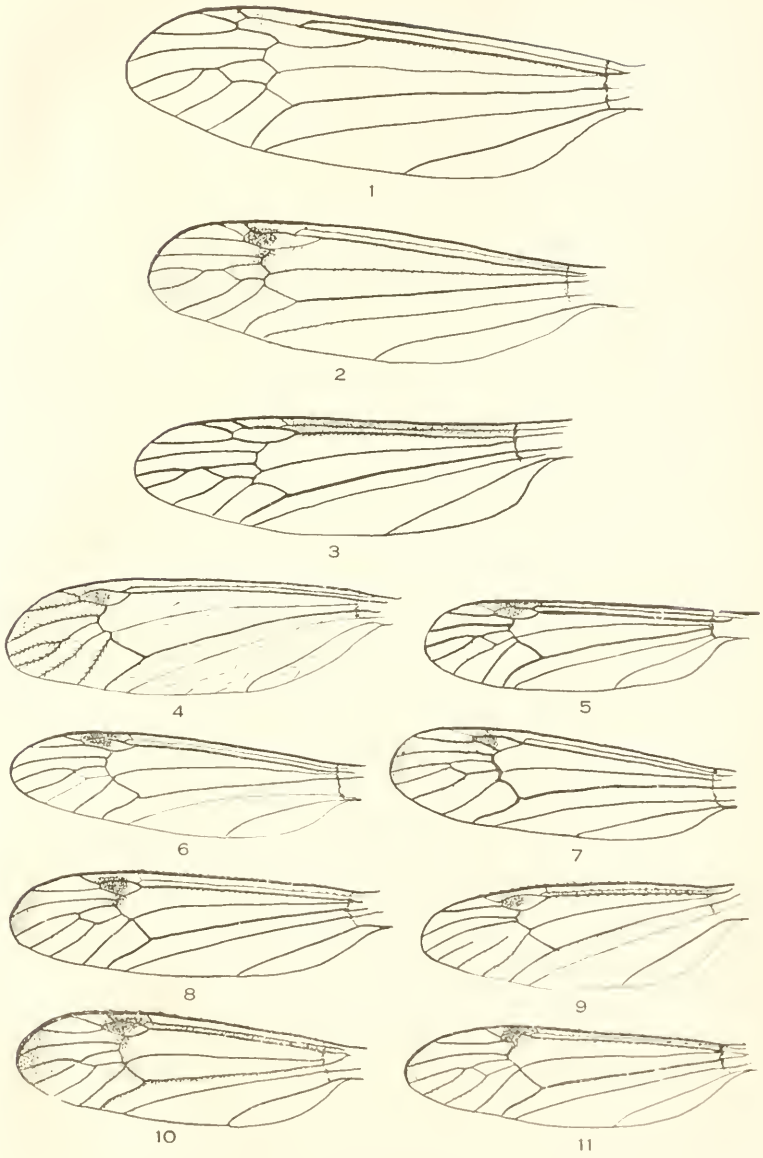
SWAIN—NEW CALIFORNIAN APHIDIDAE



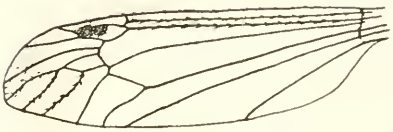

SWAIN—NEW CALIFORNIAN APHIDIDAE



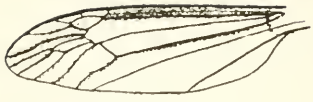

CRESSON—COSTA RICAN DIPTERA



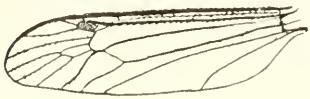

DIETZ NORTH AMERICAN TIPULIDAE



12

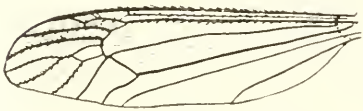


13



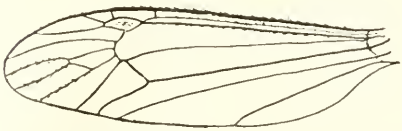
14

15

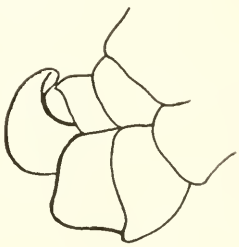


16

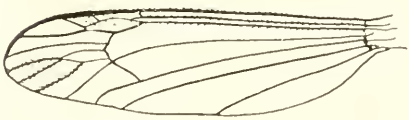
17



18

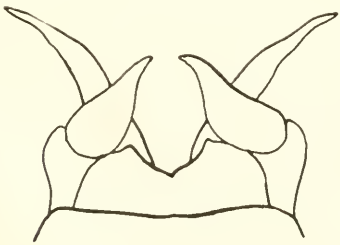


21

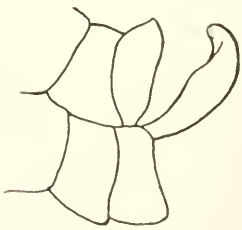


19

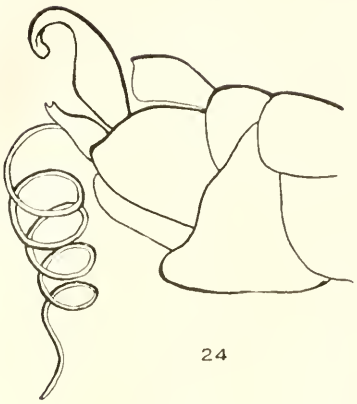
20



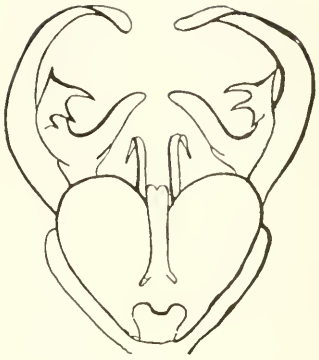
23



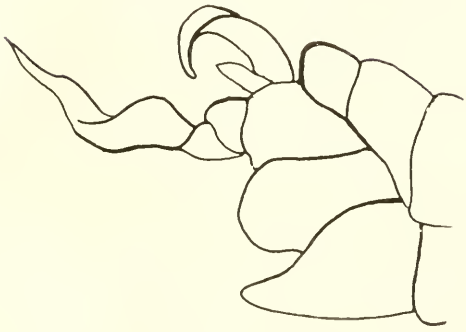
22



24

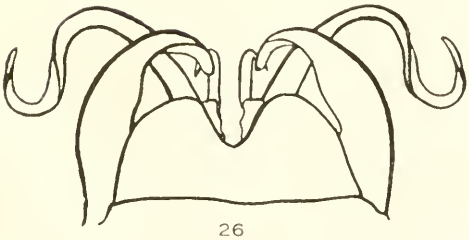


27

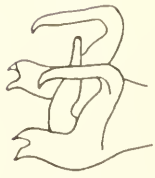


25

27A

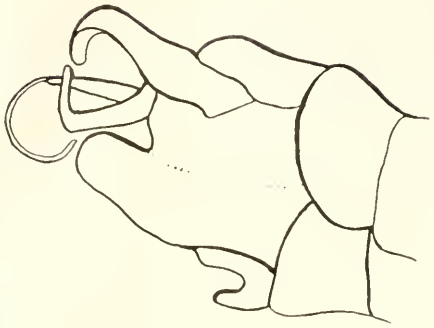


26

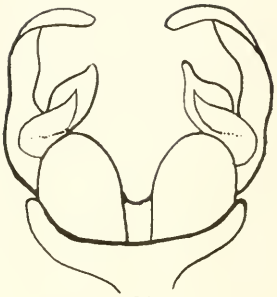


27B

DIETZ—NORTH AMERICAN TIPULIDAE

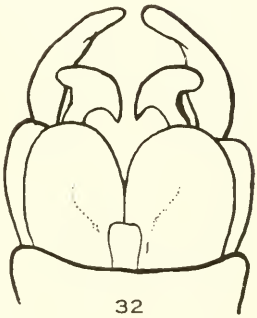


28

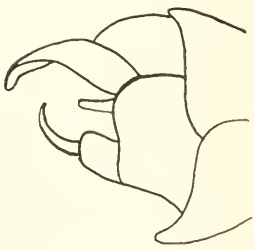


31

29



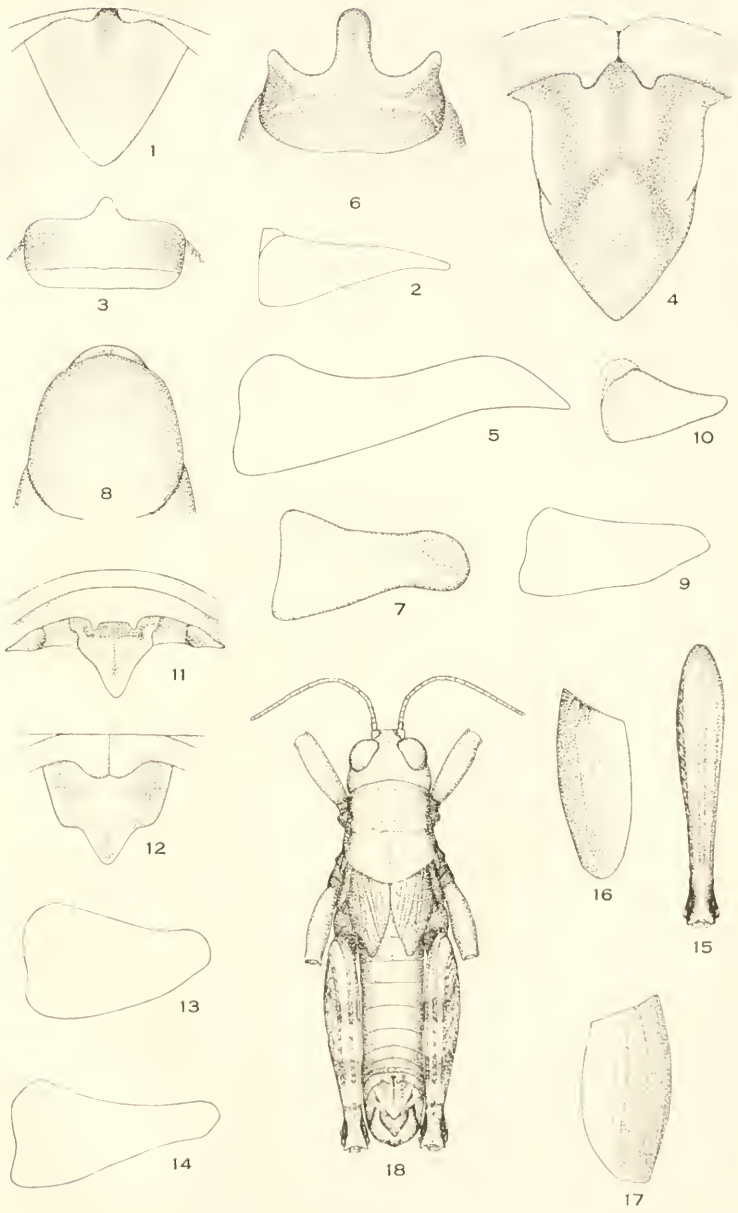
32



33

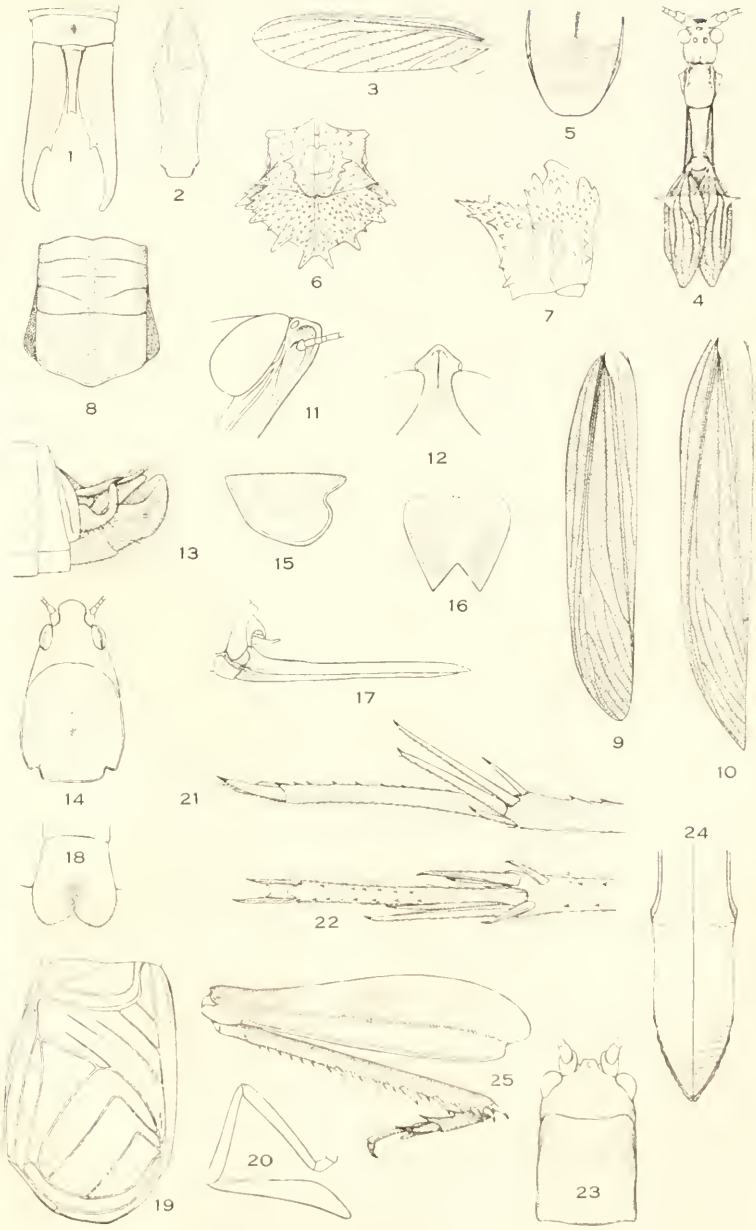
30

34




HEBARD—NEW NORTH AMERICAN MELANOPLI

MARCHAND—ABDOMINAL PATTERN IN TABANIDAE




REHN—BRAZILIAN DERMAPTERA AND ORTHOPTERA

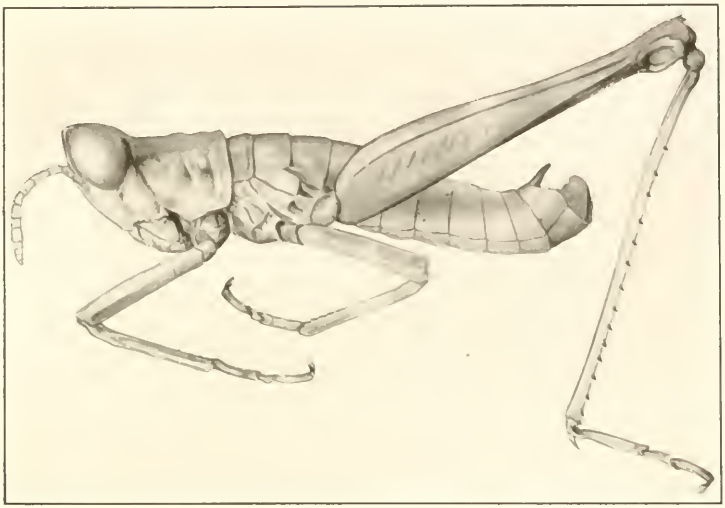


Fig. 1. *Psychomastax psylla* new genus and species. Lateral view of male (*type*). (X 7)

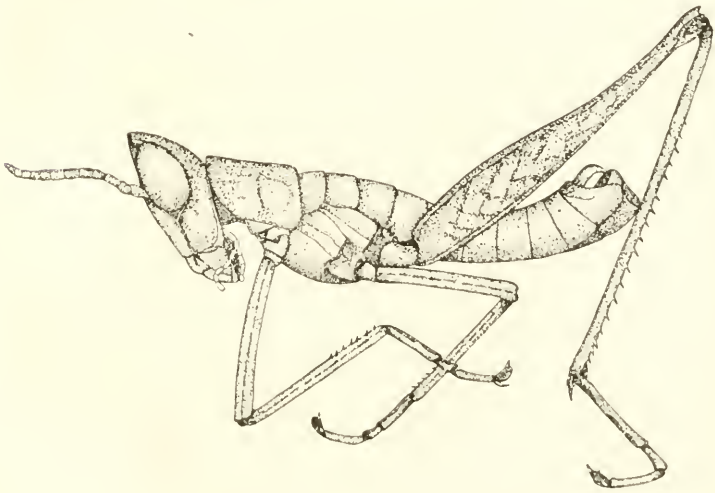
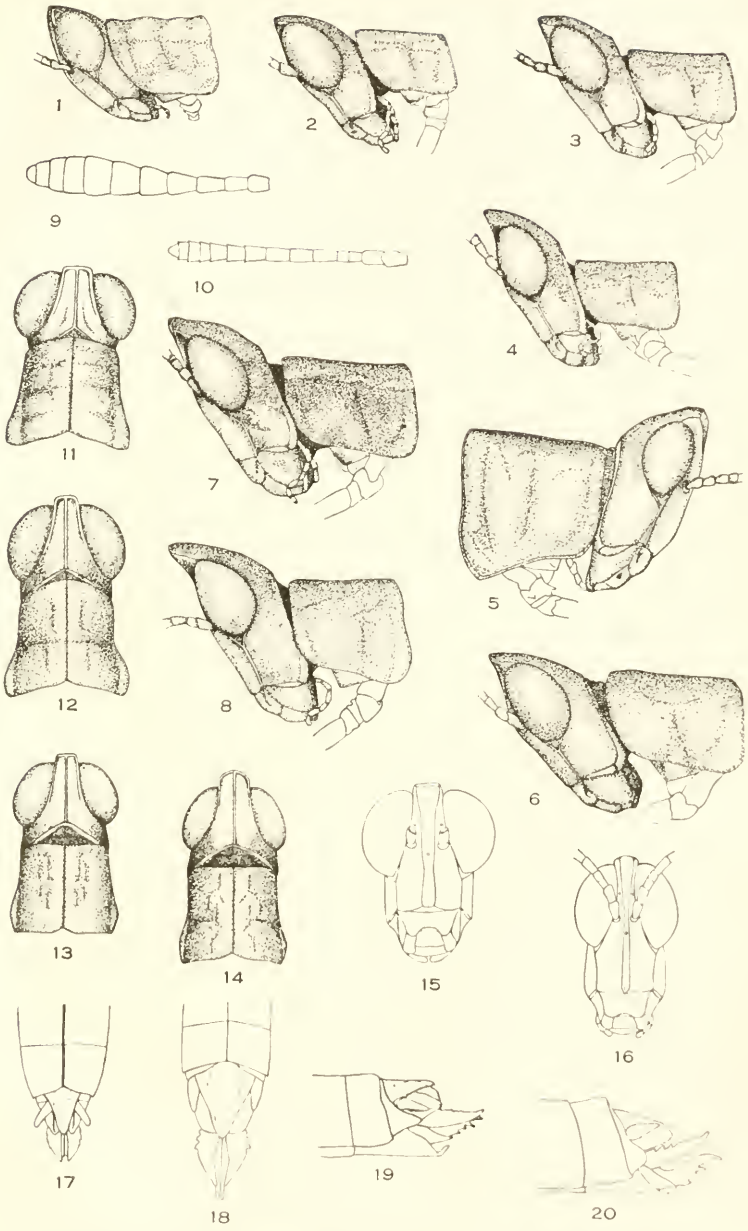
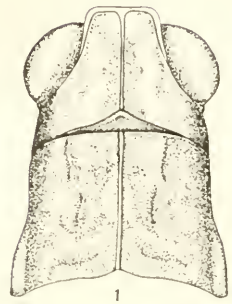
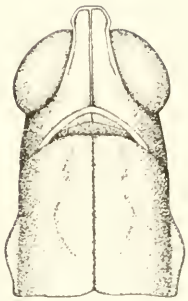
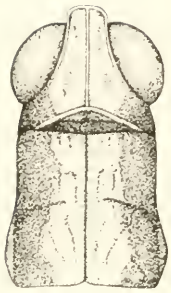


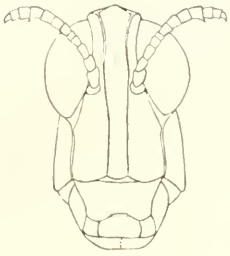
Fig. 2. *Morsea californica californica* Scudder. Lateral view of male, Mount Lowe, California. (X 6)

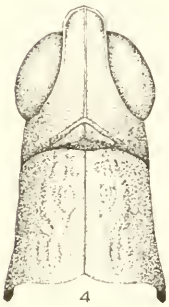

1
2
3
9
10
4
11
7
5
12
8
6
13
14
15
16
17
18
19
20


1


2


3


5


4

6

7

9

8

10

11

Fig. 1. High slopes of San Gabriel Mountains, Los Angeles County, California. View northward from summit of Mount Lowe. Upper portion of region frequented by *Morsea californica californica*. (Photograph by Rehn and Hebard.)

Fig. 2. Middle slopes of San Gabriel Mountains, Los Angeles County, California. Looking down on Echo Mountain and the lower country about Pasadena. Typical habitat of *Morsea californica californica* in the middle portion of its vertical range. Vegetation largely composed of chamisal (*Adenostoma fasciculatum*) and manzanita (*Arctostaphylos*). (Photograph by Rehn and Hebard.)

Fig. 1. Tujunga Wash, at Roscoe, Los Angeles County, California. Looking toward the Verdugo Hills, and, in the distance, the San Gabriel Mountains. Area of extension of range of *Morsea californica californica* along a tongue of suitable environment projecting into the lower country. (Photograph by Rehn and Hebard.)

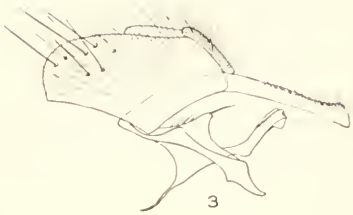
Fig. 2. Chaparral on upper slopes of Mount Tamalpais, Marin County, California. Habitat of *Morsea californica tamalpaisensis*. Chief components of this chaparral are chamisal (*Adenostoma fasciculatum*) and manzanita (*Arctostaphylos*). (Photograph by Rehn and Hebard.)

Fig. 1. Slopes at Caliente, Lincoln County, Nevada. Walls of lateral canyon of Meadow Valley. Habitat of *Morsea californica dumicola*. (Photograph by Rehn and Hebard.)

Fig. 2. Environment at Crestline, Lincoln County, Nevada. Vegetation chiefly sage and Utah Juniper (*Juniperus utahensis*). Habitat of *Morsea californica dumicola* at upper limits of its distribution. (Photograph by Rehn and Hebard.)

1

2


3

4

5

6

7

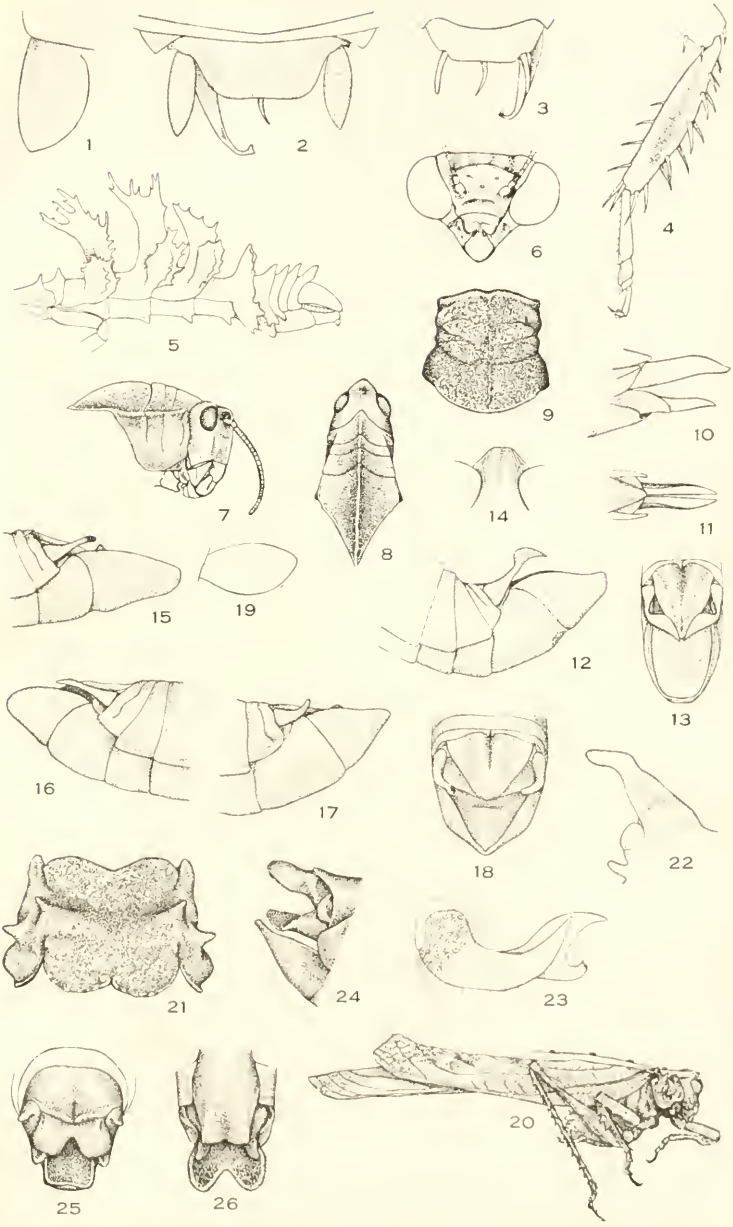
8

9

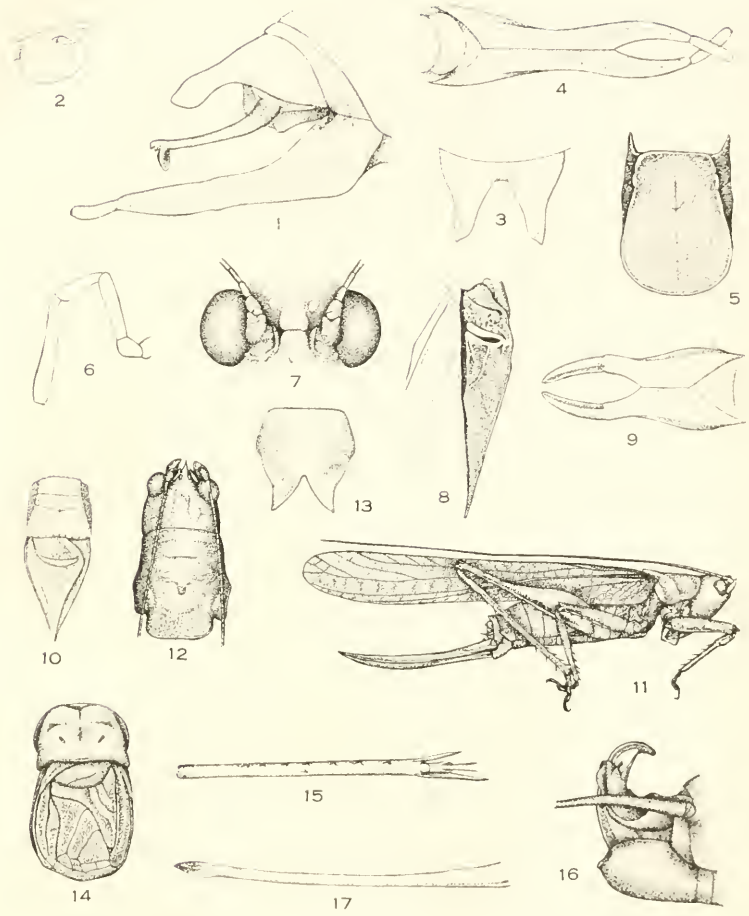
10

11

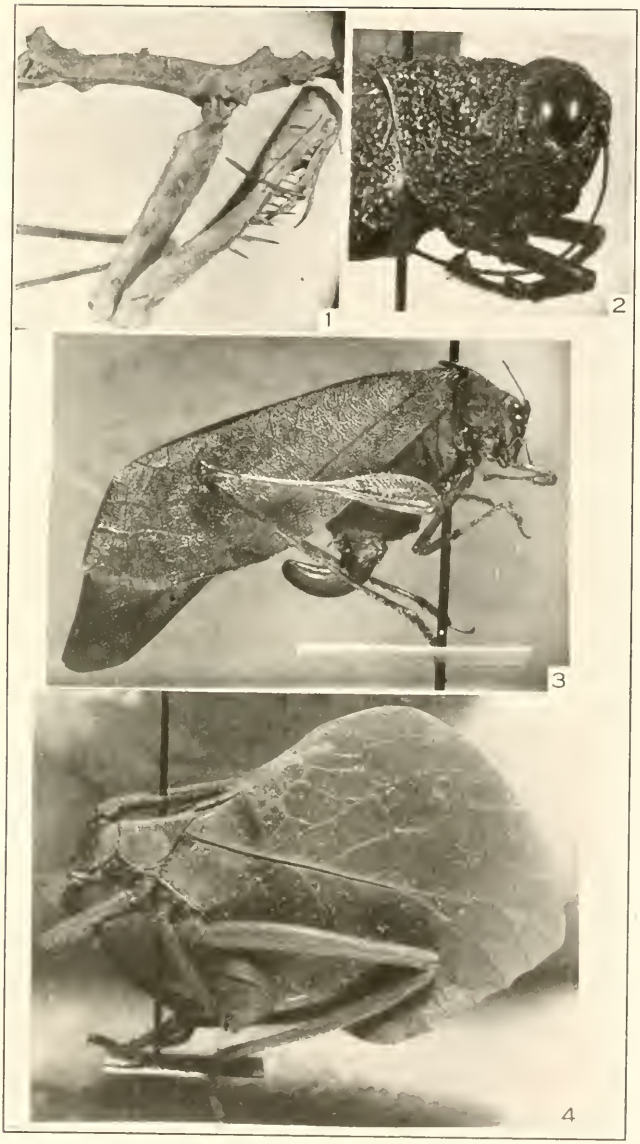
12



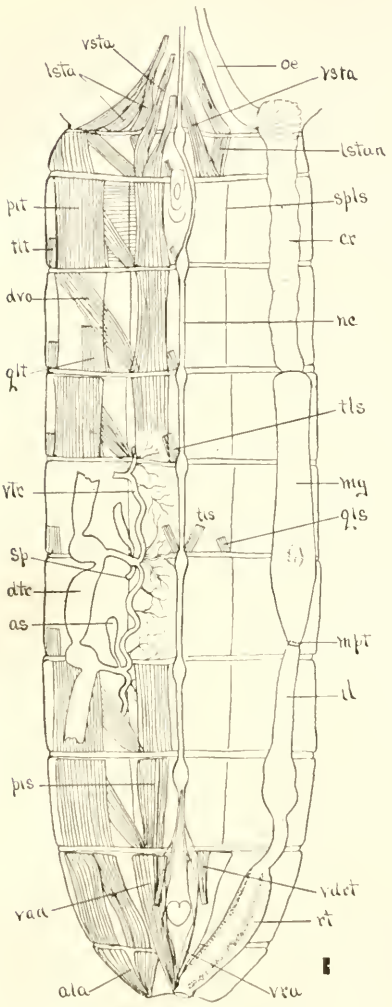

REHN NEW TROPICAL AMERICAN ORTHOPTERA

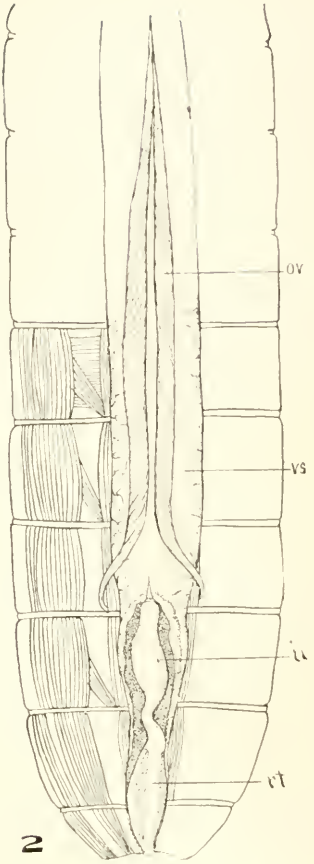


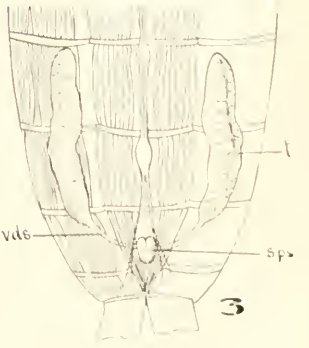

REHN—NEW TROPICAL AMERICAN ORTHOPTERA

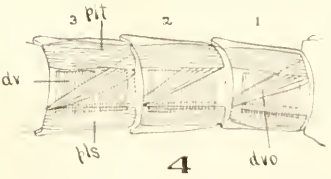



REHN—NEW TROPICAL AMERICAN ORTHOPTERA

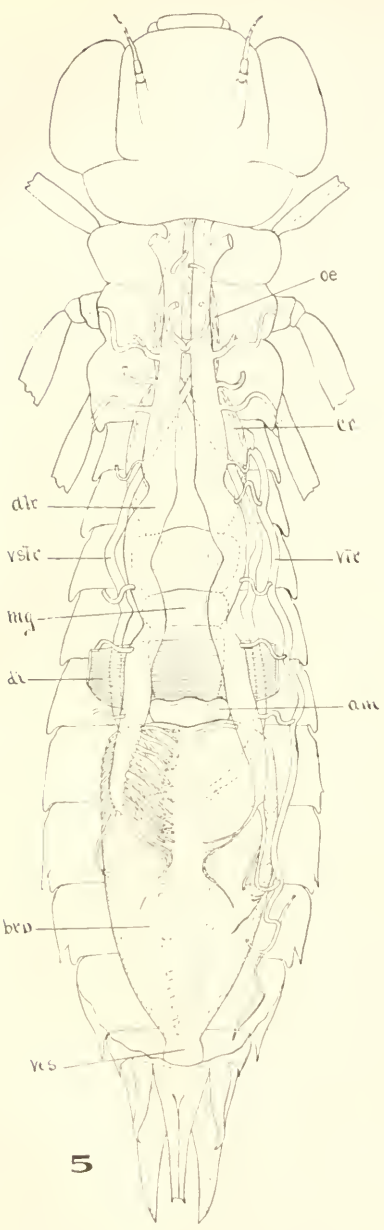


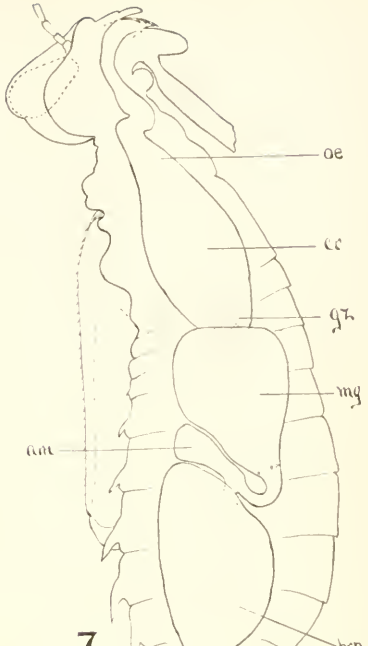



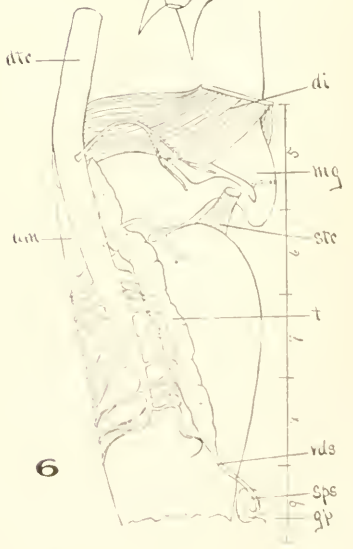

WHEDON—MORPHOLOGY OF ABDOMEN IN ODONATA




5

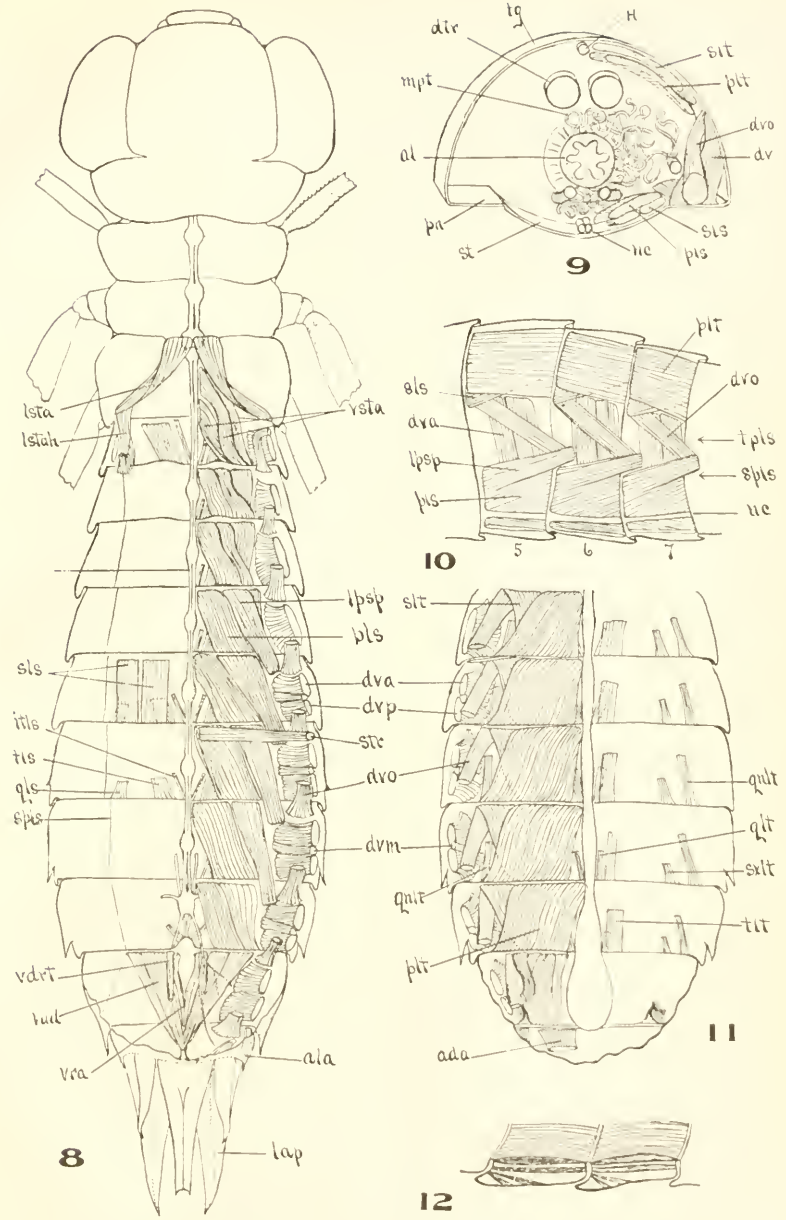



7

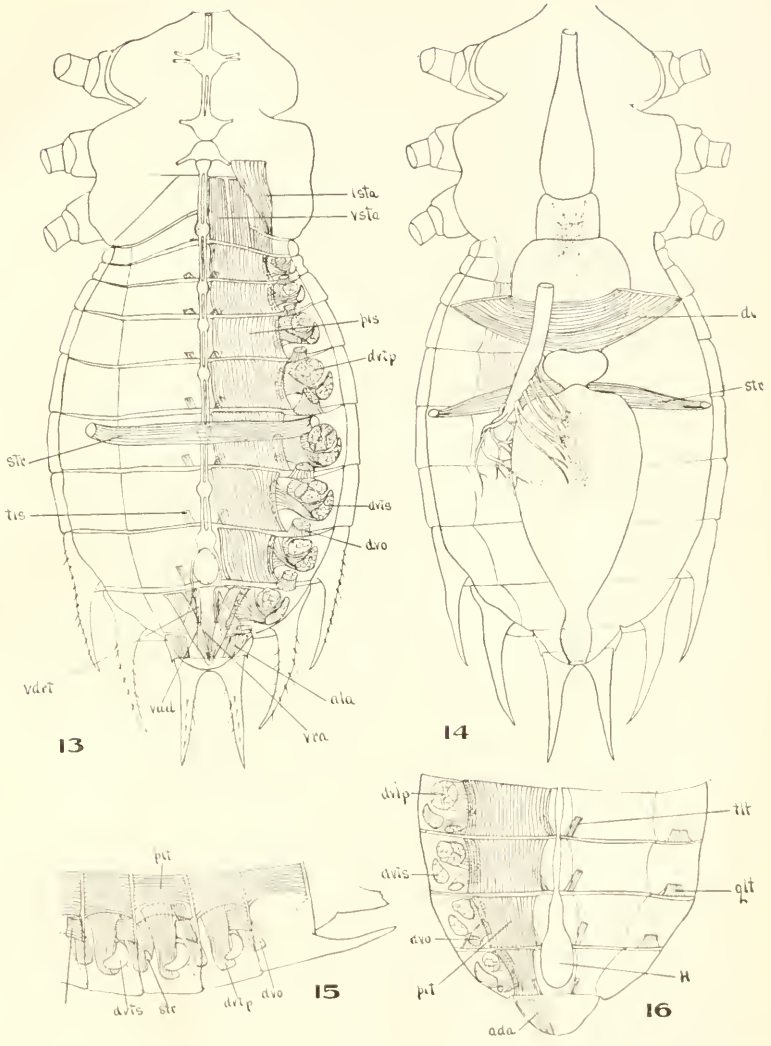



6

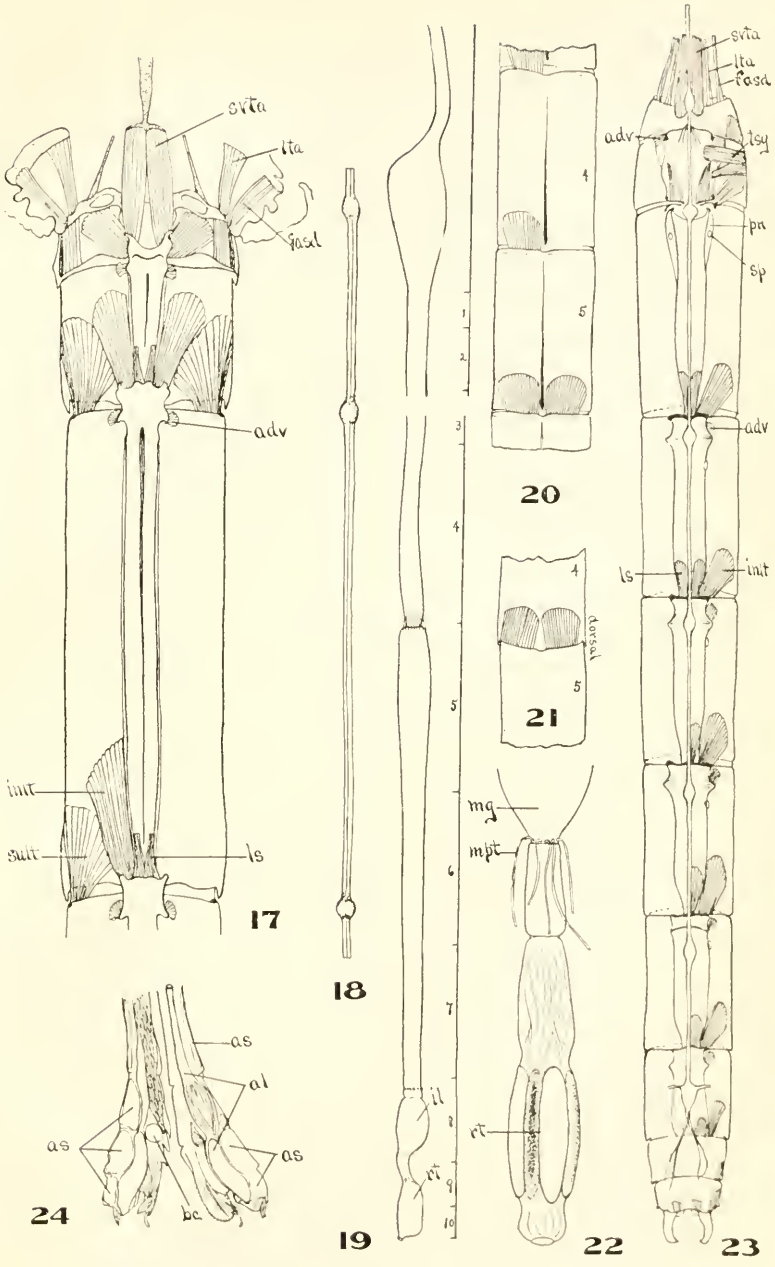
WHEDON—MORPHOLOGY OF ABDOMEN IN ODONATA



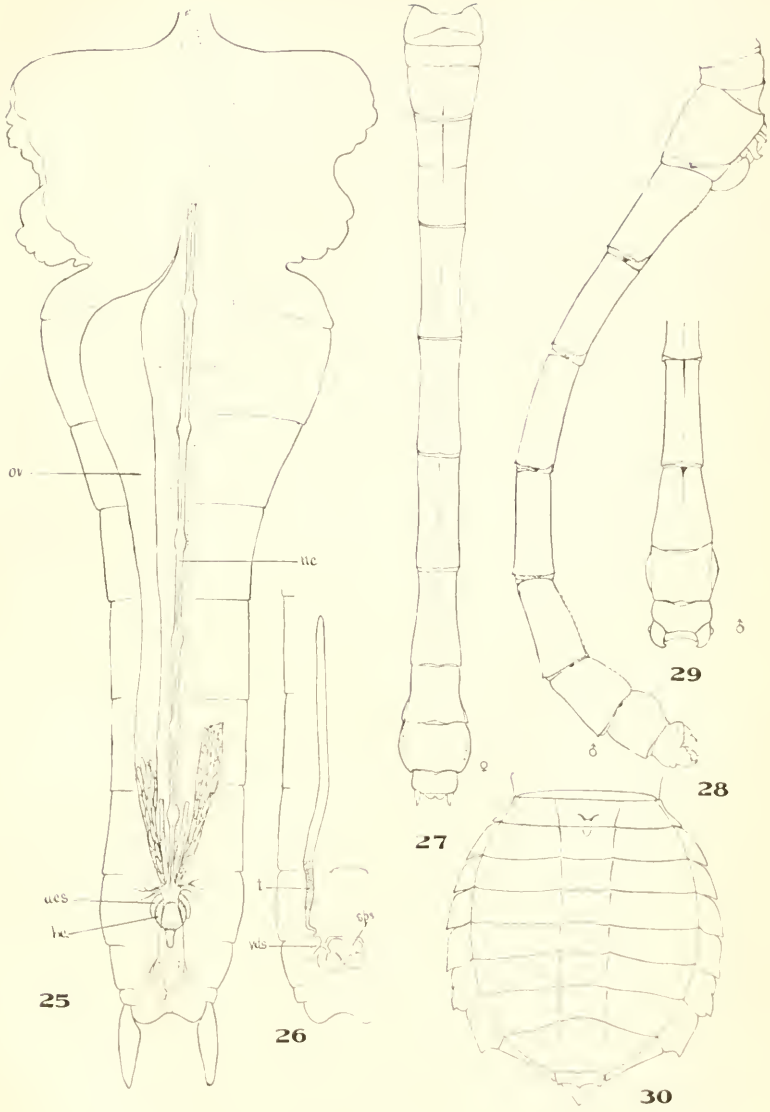

WHEDON—MORPHOLOGY OF ABDOMEN IN ODONATA



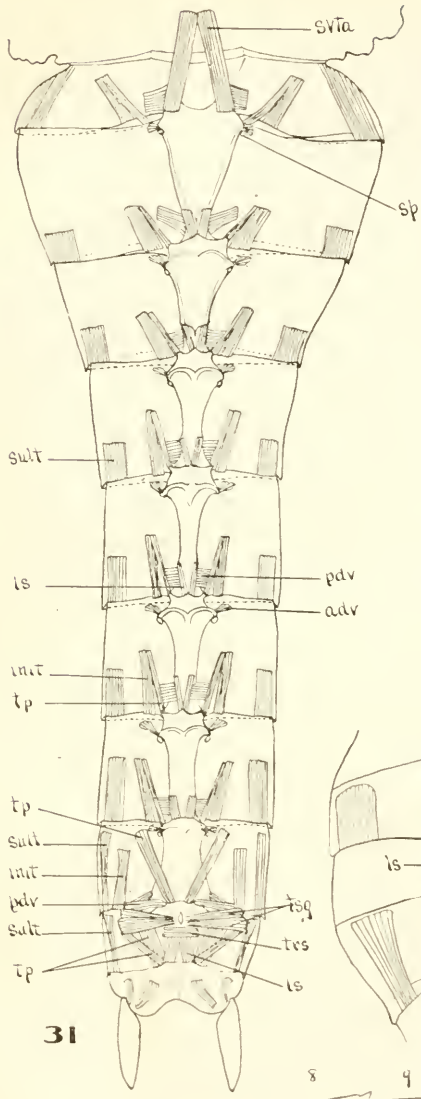

WHEDON—MORPHOLOGY OF ABDOMEN IN ODONATA



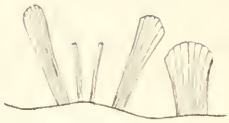

WHEDON—MORPHOLOGY OF ABDOMEN IN ODONATA




WHEDON—MORPHOLOGY OF ABDOMEN IN ODONATA



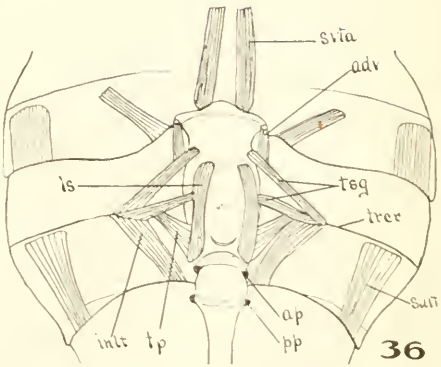

31



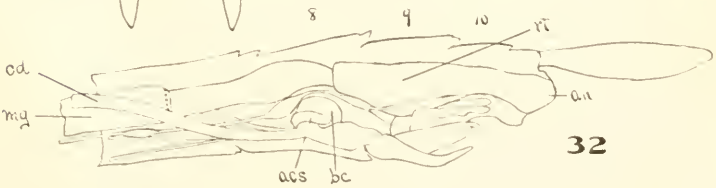
33

34

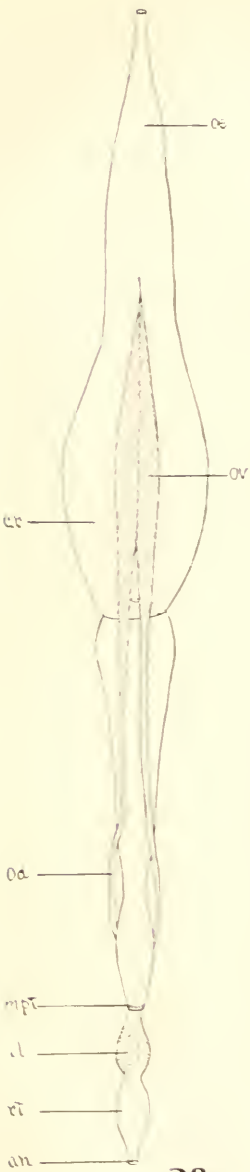
35



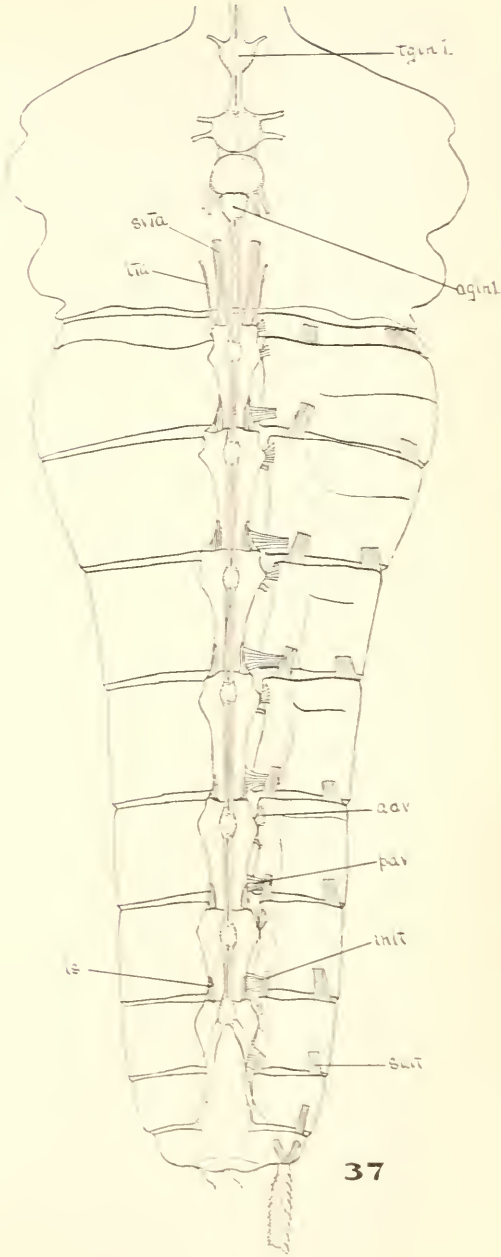

36




32

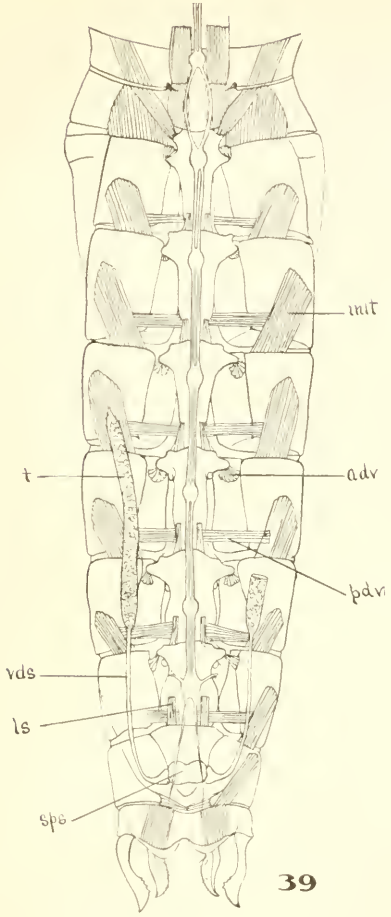



38

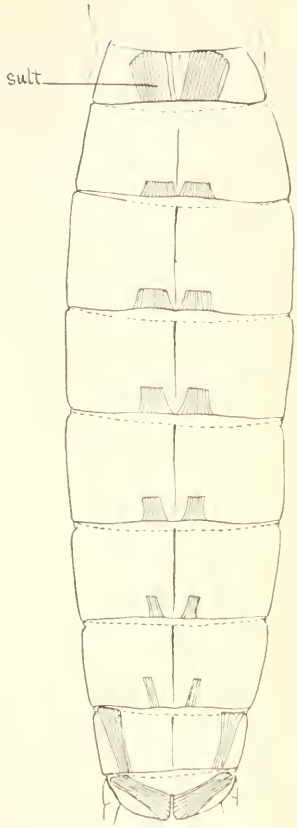



37

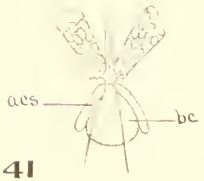
WHEDON—MORPHOLOGY OF ABDOMEN IN ODONATA



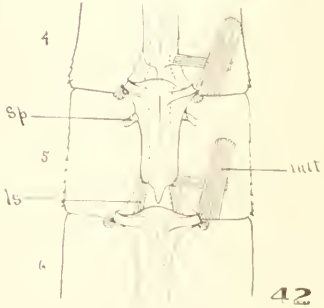

39




40




41




42

WHEDON—MORPHOLOGY OF ABDOMEN IN ODONATA

# CONTENTS

Descriptions of One New Genus and Fifteen New Species of Tropical American Orthoptera. By James A. G. Rehn . 321
(Issued November 20, 1918.)

The Comparative Morphology and Possible Adaptations of the Abdomen in the Odonata. By Arthur DeWitt Whedon . 373
(Issued January 8, 1919.)

1317

t. Soc.

SMITHSONIAN INSTITUTION LIBRARIES
3 9088 00907 1069